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ABSTRACT

Twelve different conversion plans were delineated and evaluated in the performance of this study effort. An indepth technical, financial, and cost/benefit analysis was included. One plan was determined to be distinctively more cost-effective than any of the other plans because it provided a technically feasible system that assured the maximum service capability at the optimum budget level and the minimum costs for the capability provided. This plan would increase the reader population at a rate of 20 percent per year toward a goal of 2.25 million readers. The plan included revised talking book machines, revised cassette book machines, and combination machines. Seven technical recommendations and five administrative recommendations are given for implementation of the conversion plan. (Author/PF)

ED107292

FINAL REPORT

SUBMITTED BY:

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A PLANNING STUDY FOR THE CONVERSION OF RECORDED BOOKS AND MAGAZINES FROM RIGID DISCS TO CASSETTES AND FLEXIBLE DISCS

THIS PLANNING STUDY WAS CONDUCTED
FOR THE LIBRARY OF CONGRESS
DIVISION FOR THE BLIND AND PHYSICALLY HANDICAPPED
IN ACCORDANCE WITH CONTRACT NO. LC1129

SUBMITTAL DATE:

MAY 13, 1975

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"This study was conducted and this report was prepared under a contract with the Library of Congress, Reference Department, Division For the Blind and Physically Handicapped. Organizations undertaking such projects under Government sponsorship are encouraged to state their findings and express their judgments freely. Therefore, points of view or opinions stated in this document do not necessarily represent the official position of the Library of Congress.

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SECTION 1

EXECUTIVE SUMMARY

1.1 OBJECTIVES OF RESEARCH PROGRAM

INNOVATIVE SYSTEMS RESEARCH, INC. is pleased to present its research findings to the Library of Congress - Division for the Blind and Physically Handicapped as a result of the completion of a both exhaustive and comprehensive study of all of the operations of the division.

The Library of Congress, as authorized by Public Law 89-522, conducts a national reading program for the blind and physically handicapped residents of the United States and its outlying territories and for such American citizens living abroad. Books and magazines are selected and put into recorded formats by the Division for the Blind and Physically Handicapped, for distribution through a network of state and locally-supported libraries. This network is also supported by volunteer organizations which assist by providing recordings, repairing equipment, delivering equipment and books, and training the handicapped readers.

DBPH requested that the implications involved in the establishment of new future policies and standards be thoroughly evaluated. By definition, these include:

- New or replacement recorded editions of books selected for national distribution will be issued in a unique tape cassette format only.
- Recorded editions of popular magazines will be issued only on flexible discs. Highly specialized magazines may be issued on tape cassettes.
- The new technical standards to be adopted are:
    - Cassette books, both 2-track and 4-track, will play at 15/16 ips, and Cassette Book Machines (CBM's) must provide this speed.
    - Disc magazines will play at 8-1/3 rpm, and phonograph equipment must provide this speed.

- In achieving this transition (or conversion), it is necessary to maintain the ability for all eligible readers to continue to make use of existing 33-1/3 rpm, 16-2/3 rpm and 8-1/3 rpm hard disc recorded books, existing 1-7/8 ips cassette books, and existing Cassette Book Machines that play at the 1-7/8 ips speed only.

The total eligible target population for the DBPH Audio Services Program is estimated to range from 5,781,500 - 11,384,500 readers. For the purpose of this study, 7.6 million readers were chosen as the eligible target population. The average large public library system serves 20 - 25% of its potential readers. DBPH desires to provide its recorded services to a minimum of 30% of its target population, or the equivalent of at least 2,250,000 readers. During this study, the capability of DBPH to provide the following actions was evaluated:

- To attract and provide adequate service to an increasing number of readers at an annual rate of 20% over the five years, beginning with the base year of FY 1976.
- To accomplish the conversion smoothly in three to five years, using FY 1976 as the base year.

The Final Report of this study provides a comprehensive description of the methods of research investigation utilized, an analysis of the results obtained, and the recommended actions needed to achieve the DBPH objectives.

1.2 METHOD OF INVESTIGATION

A uniform framework for analysis was achieved by observing the efforts of DBPH and its suppliers and by comparing these efforts to the readers' requirements. It was necessary to disaggregate all of the elements involved in the entire program and examine each carefully, in order to extend the domain of inquiry to identify and provide precognition of the various states of knowledge needed to implement the future conversion program. To solve problems successfully, it was first necessary to recognize their existence. The research effort focused strongly on identifying:

- The known information
- The known-unknown information capable of being obtained
- The unknown information that would be difficult to obtain

The research methodology required the study of published documents and internal memoranda. Interviews were conducted with key personnel within the DBPH organization and with the suppliers of equipment and recorded material.

The significant impact measures chosen for evaluation included:

- Reader satisfaction with the quality and technical performance of both the equipment and the recorded material.
- Reader satisfaction with the types of material selected for recreational and informational purposes.
- Reader satisfaction with the availability of the service provided by the entire network.
- Financial requirements to meet DBPH objectives, and the time required to implement the recommended conversion program.

Data on readers was acquired in reference to population characteristics, material preferences, and problems encountered with the equipment supplied. Current DBPH procedures and their associated problems were described in detail, including DBPH needs for new skills and automated information systems and their inability to attract new equipment and recorded material suppliers. The problems of the current suppliers were delineated, along with the existing difficulties related to the technical performance of their equipment and the intelligibility of the recorded material. The overall capability of the network to make sufficient equipment and recorded material available to the readers - in accordance with their wishes - was evaluated. Essential financial and time estimates which affect the availability and distribution of equipment and recorded material, were provided, including research and development and production costs.

The analytical methodology employed during the program included the use of system analysis techniques, group consensus and judgment modeling, cross-impact analysis, financial and cost/benefit modeling, and forecasting and Pert planning techniques. The resultant data was presented continually throughout the program to the responsible DBPH personnel for review and validation.

1.3 RESULTS OF THE INVESTIGATION

Timely action by DBPH is mandatory in order to provide the program improvements needed to attract new readers to the program. The study results indicate that improvements are needed in each of the following areas and activities:

Research and Development

- The skills of the DBPH technical staff, and the equipment and recorded edition specifications needed to insure that the desired quality of performance is achieved and that the best and most current technology is utilized.

- The design of new equipment to provide the most cost-effective method of supplying more equipment to the readers.
- The packaging, labeling, maintenance and repair of equipment and recorded material, and the support provided to the regional library network and readers.
- The requirements imposed on the suppliers necessary to assure adequate quality control and product life expectancy.
- The methods utilized in conducting reader acceptance tests and the collection and dissemination of information to suppliers on the malfunctions occurring in the field in sufficient time for corrective action to be taken.

DBPH Policies and Procedures

- The development of new selection criteria for providing an increase in the number of title acquisitions for both books and magazines and new survey methods for determining reader preferences and suggestions.
- The reader application form and the enforcement of its use by the network. A reduction in the problems encountered by the reader when moving from an area served by one regional library to an area served by another.
- Making eligible readers aware of the services provided by the program.
- The maintenance of records and the management of information of all types within DBPH, including statistical, financial and product malfunction data.
- The procurement methods currently utilized by DBPH, in order to obtain more suppliers, technological innovation and a better quality product.

1.4 RECOMMENDATIONS

Twelve different conversion plans were delineated and evaluated in the performance of this study effort. Plan 2 is the recommended choice to achieve the purposes set forth by DBPH. This plan is distinctively more cost-effective than any of the other plans because it provides a technically feasible system that assures the maximum service capability at the optimum budget level and the minimum costs for the capability provided. An evaluation of similar cost-effective candidate plans led to the selection of Plan 2 as the plan that provides the maximum cost/benefit to the readership. Table 1.1 (shown at the end of this summary) provides a compilation of the capability provided and the associated cost relationships.

The successful implementation of this conversion plan requires these actions:

Technical Recommendations

- The acquisition of the 8-1/3 rpm rigid disc should be converted to the acquisition of only 8-1/3 rpm flexible discs at the start of FY 1977.
- Cassette books (C-90's) should be procured in 4-track versions at a speed of 15/16 ips only if the specifications for the cassette shell and tape utilized are revised, as a result of a comprehensive study and test program.
- The use of the flexible disc for the reproduction of the most popular books is recommended if the reader playing test suggested proves to be successful, and if a good book container can be designed.
- The design of a new combination phonograph-cassette machine utilizing standardized and compatible subassemblies is needed. These compatible subassemblies can be used in a Revised Talking Book Machine (RTBM) and in a Revised Cassette Book Machine (RCBM). The compatible subassemblies require new designs for a motor, amplifier, speaker, tone arm, turntable-cassette assembly and new cases.
- The purchase of large quantities of standardized compatible subassemblies for each of the equipment will provide a reduction in the cost and time utilized in the repair of malfunctioning equipment. The multi-state centers and the volunteers should be provisioned with additional quantities of spares and test equipment, in order to insure that they can provide the maintenance support needed to service the significant increase in readers.
- It is necessary to provide the reader with the best intelligible sound and this requires a complete reevaluation of recording and equipment specifications matched to reader hearing characteristics.
- A comprehensive technological exploration program is required, including studies, research and development, testing and the preparation of revised procurement specifications. The acquisition by DBPH of a key individual with both broad-based technical and administrative skills would develop the technical organization needed

to meet the requirements of the conversion program.

Administrative Recommendations

- Additional support should be provided at the libraries in the network to assist in the testing and maintenance of cassette books and to increase their storage capabilities.

- A program to purchase standard high quality recorded master tapes from both non-profit and volunteer organizations should be initiated. These tapes could be reproduced by flexible disc suppliers and cassette duplicators.

- Since the DBPH administration projects a plateau in the increase of staff personnel, new automated information systems are needed to support the projected increase in readership. An on-line information management system, including product malfunction, inventory, reader eligibility, and financial and selection statistics, is recommended.

- The current procurement procedures must be studied in order to provide for the mass purchase of compatible subassemblies. The form of incentive contract required to interest new suppliers, and the means by which DBPH can provide the administrative and logistics support to implement the conversion program, must be evaluated.

- In order to meet the recorded material needs of the readers, it is necessary to increase the new title acquisition and reproductions at a rate of 20% per year.

1.5 SUMMARY

The supporting background data for the recommendations provided is contained in the following portions of this Final Report. This includes an in-depth technical, financial and cost/benefit analysis. A program plan and preliminary model of the proposed budget for Plan 2 are also included.

Table 1.1

THE RECOMMENDED AUDIO SERVICES CONVERSION PLAN
(Summarized for Five Year Period)

CAPABILITY RELATED TO QUANTITY/COST RELATIONSHIP

Description	Quantity/Cost Relationship
Overall Program Cost	$ 88,512,000
Number of Readers	1,192,320 Readers
New Equipment Purchased	866,000 Units
Equipment Complement	
. Current Talking Book Machines	95,000 Units
. Current Cassette Book Machines	107,000 Units
. Combination Machines	295,000 Units
. Revised Talking Book Machines	351,000 Units
. Revised Cassette Book Machines	18,000 Units
Recorded Products	
. Flexible Disc Magazines	12,810,000 Copies
. Flexible Disc Books	6,679,000 Copies
. Rigid Disc Books	550,000 Copies
. Cassette Books	2,400,000 Copies

FACTOR ANALYSIS (RELATIONSHIP TO OTHER PLANS)

Factor	Value for Five Year Period
Cost/Benefit Ratio	2.33 (least disbenefit to readers)
Total Number of New Titles	7,442 (equal to other plans)
Cost Effectiveness Ranking	
. Five Year Lowest Cost Program	$ 75,741,000
. Five Year Highest Cost Program	$104,259,000

AVERAGE FIVE YEAR EQUAL BUDGET/UNEQUAL CAPABILITY PER READER
(Statistics Related to Programs Budgeted at $88,512,000)

Five Year Cost	$ 74.23 (Same)
Potential Utilization of New Equipment	.726 Units (Highest)
Potential Utilization of Recorded Product	18.82 Units (Highest)

SECTION 2

DATA COLLECTION AND ANALYSIS

2.1 Library of Congress - Division for the Blind and Physically Handicapped - Background and Structure

In 1934, when early home phonographs were playing at 78 rpm, the Library of Congress began disseminating phonographs specially designed for the blind, which played at 33-1/3 rpm. These "talking book" machines, developed by the American Foundation for the Blind, were originally sold to visually handicapped individuals at cost. In 1935, President Roosevelt, through the Works Progress Administration, instituted a free loan program. In 1946, the Library of Congress received an appropriation under this program to produce the machines on a contractual basis.

During the following fourteen years, confusion over personnel responsibilities for repairs, as well as further technical developments, resulted in readers having to wait for months at a time for their machines. In 1960, in order to alleviate this problem, the Library of Congress initiated pilot studies with the Telephone Pioneers of America, a community service group of retired telephone industry employees who had been transcribing textbooks into braille since 1955. In the pilot studies, the Pioneers utilized their technical and electronic skills in taking over the service repairs of the Talking Book Machines. They were instructed to make major repairs of machines and to train agency personnel to make minor repairs. In that same year, the pilot programs were declared a success, and the Library of Congress requested an extension of the program to additional geographic areas. An estimated 150,000 machines were repaired and 36,000 conversions to 8-1/3 rpm were made between that time and 1970.

The Division for the Blind and Physically Handicapped has had its own testing facility and staff since 1967 and is being expanded as more sophisticated technology is developed in order to maintain quality control. Over the years, the Talking Book Machine has become more streamlined, efficient and portable as hand wired circuitry has been replaced with solid state printed circuit boards. Features have been developed for further ease of use by the visually or physically handicapped, as well as the addition of 16-2/3 rpm and 8 1/3 rpm speeds, in addition to the 33-1/3 rpm speed.

2.1.1 Regional and Subregional Libraries

From the beginning of the Library of Congress program, records were produced by the Library's Division for the Blind and were distributed - free of charge - through regional libraries. The regional library concept remains the backbone of the Library of Congress free library service to individuals who are unable to use or to read standard printed material due to visual or physical impairment. Readers are provided with postage-free mail service for all talking books and materials. Subregional libraries are also used -

some of which are local public libraries having a collection of current materials and direct access to the resources of their regional libraries. Handicapped readers' reference and advisory services are also provided.

The current list of all regional and subregional libraries and machine-lending agencies cooperating with the Library of Congress to serve blind and physically handicapped readers, as of January 1, 1975, is contained in Appendix C of this report.

2.1.2 Eligibility

The original act of March 3, 1931, outlined the requirements for those eligible to receive free DBPH visual aid materials. This included the required appropriations for "books published either in raised characters, on sound-reproduction recordings or in any other form . . .," as well as musical scores and texts. The original act provided only for the blind. Under the provisions of Public Law 89-522, dated July 30, 1966, the 89th Congress revised the original act. This revision extended the eligibility requirements to those who have other physical handicaps.

Under the provisions of the 1931 Act, the Library of Congress discovered that certain terminology covering eligibility requirements created an inaccurate diagnosis of specific conditions, and that those identified as competent to make judgments on eligibility criteria for one specific condition were not so qualified for others. As a result of an inquiry of nationally prominent individuals specializing in such physical and organic disabilities, the eligibility requirements now encompass the following:

- Blind persons whose visual disability, with correction and regardless of optical measurement, is certified by competent authority as preventing the reading of standard printed material.
- Other physically handicapped persons are:
    - Persons whose visual disability, with correction and regardless of optical measurement, is certified by competent authority as preventing the reading of standard printed material.
    - Persons certified by competent authority as unable to use or unable to read standard printed material as a result of physical limitations.
    - Persons certified by competent authority as having a reading disability resulting from organic dysfunction and of sufficient severity to prevent their reading printed material in a normal manner.
- "Competent authority" has been defined to include doctors of medicine (the only accepted authority for organic dysfunctions), opthal-

mologists, optometrists, registered nurses, therapists, and professional staff of hospitals, institutions and public or welfare agencies (social workers, case workers, counselors, home teachers and superintendents). Certification may be made by professional librarians or others acceptable to the Library of Congress in lieu of any of the above mentioned specialists.

- Qualified readers must be residents of the United States or of its territories, or American citizens abroad temporarily. Veterans receive first preference for all such services.

A sample LC-DBPH Application for Free Library Service is contained in Appendix D of this report.

Twenty handicapping conditions which are likely to affect the ability to read are divided into two major categories: I. Certain Eligibility and II. Possible Eligibility. Those conditions which satisfy all the eligibility requirements of the Library of Congress program as listed above are included in Category I and those conditions which are likely to be eligible are included in Category II. Data on the estimated number of individuals with each of these handicapping conditions were identified in a 1973 document.*

- Category I. Certain Eligibility

Handicapping Conditions and Incidence Sources	Estimated Number of Individuals
Severe Visual Impairment 1971 estimate from the National Center for Health Statistics based on interviews of the civilian, non-institutionalized population.	1,306,000
Institutionalized Blind Adults age 18 and over, as measured by the 1967 Social Security Survey of Institutionalized Adults.	12,000
Absence of One or Both Arms or Hands Based on data from the National Center for Health Statistics National Health Survey, 1963-65.	81,000

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* DBPH Specification for the Cassette/Phonograph Playback Machine, dated December 1973.

Cerebral Palsy, complete or partial paralysis 1971 estimate based on health interviews by the National Center for Health Statistics.	181,000
Muscular Dystrophy, completely disabled 1973 estimate from the National Institute of Neurological Diseases and Stroke.	50,000
Quadriplegia 1971 estimate from the National Center for Health Statistics.	51,000
Hemiplegia 1971 estimate from the National Center for Health Statistics	199,000
Total	1,880,000

- Category II. Possible Eligibility

Handicapping Conditions and Incidence Sources	Estimated Number of Individuals
Arthritis 1969-1970 estimate from the National Center for Health Statistics representing the number of persons unable to carry on their major activity because of arthritis or rheumatism.	857,000
Cerebral Palsy (excluding those paralyzed) 1973 estimate of the United Cerebral Palsy Association.	569,000
Huntington's Disease 1973 estimate from the National Institute of Neurological Diseases and Stroke.	14,000
Learning Disabilities According to the 1973 estimate from the Association for Children with Learning Disabilities, 3 - 5% of the school population is neurologically impaired.	1,542,000 - 2,570,000

Mental Retardation The National Association for Retarded Children estimated in 1973 that 3% (6.1 million) of the U.S. population would be identified as mentally retarded before they were 15 years old. According to the President's Committee on Mental Retardation, only 25% of all mental retardation can be attributed to a biomedical factor (1,525,000). However, under Federal legislation like the Developmental Disabilities Services and Facilities Construction Act of 1970, mental retardation is regarded as a physical handicap.	1,525,000 - 6,100,000
Multiple Sclerosis and related diseases 1973 estimate of the National Multiple Sclerosis Society.	500,000
Muscular Dystrophy (except completely disabling) 1973 estimate of the National Institute of Neurological Diseases and Stroke.	150,000
Myasthenia Gravis 1973 estimate of the National Institute of Neurological Diseases and Stroke.	30,000
Paraplegia 1971 estimate from the National Center for Health Statistics.	102,000
Parkinson's Disease 1973 estimate of the National Institute of Neurological Diseases and Stroke.	200,000
Spina Bifida 1973 estimate of the National Institute of Neurological Diseases and Stroke.	27,500
Spinal Cord Injury 1973 estimate of the National Institute of Neurological Diseases and Stroke.	125,000

. Tumors of the Brain and other parts of the Nervous System 1973 estimate of the National Institute of Neurological Diseases and Stroke.	140,000
Total	5,781,500 - 11,384,500

The total eligible target population thus ranges from 7,661,500 - 13,264,500 individuals. The eventual target population was chosen to be 7.6 million. A large public library system serves 25% of its potential readers. It is the wish of DBPH to service a minimum of 30% of its potential readers. The achievement of this target goal will be attempted at a 20% rate of increase in the number of readers per year.

2.1.3 Library of Congress - DBPH Structure

The latest organization chart of the Division for the Blind and Physically Handicapped is shown in Figure 2.1. It clearly identifies the responsibilities of each of the designated offices, sections, units and service organizations.

2.1.4 Interviews with DBPH Staff Members

Interviews were conducted with the following DBPH Staff Members on the subjects listed:

- Chief
  Assistant Chief
  Office of the Chief

    - Division Policy
    - Congressional Needs
    - Historical Background
    - Organizational Concepts
    - Future Plans

- Program Analyst
  Project Coordination Office

    - Project Requirements
    - Data Source Identification
    - Visit Scheduling
    - Planning Formats
    - Formats for Presentation

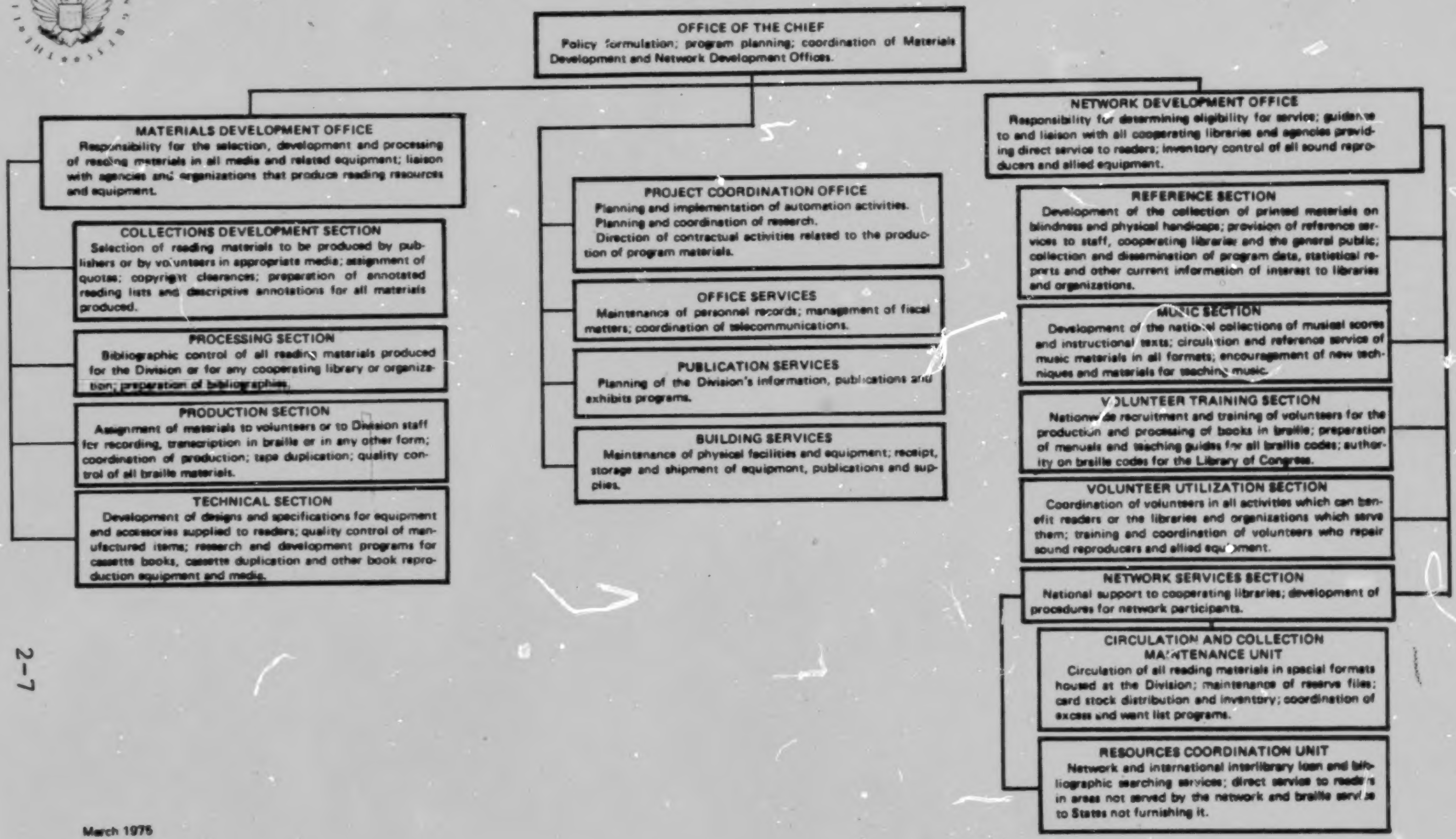
- Contracting and Planning Specialist
  Project Coordination Office

    - Procurement Practices
    - Regulations
    - Buy American Act
    - Supplier Background

DIVISION FOR THE BLIND AND PHYSICALLY HANDICAPPED
THE LIBRARY OF CONGRESS

Figure 2.1

ORGANIZATION CHART



OFFICE OF THE CHIEF
Policy formulation; program planning; coordination of Materials Development and Network Development Offices.

MATERIALS DEVELOPMENT OFFICE
Responsibility for the selection, development and processing of reading materials in all media and related equipment; liaison with agencies and organizations that produce reading resources and equipment.

COLLECTIONS DEVELOPMENT SECTION
Selection of reading materials to be produced by publishers or by volunteers in appropriate media; assignment of quotas; copyright clearances; preparation of annotated reading lists and descriptive annotations for all materials produced.

PROCESSING SECTION
Bibliographic control of all reading materials produced for the Division or for any cooperating library or organization; preparation of bibliographies.

PRODUCTION SECTION
Assignment of materials to volunteers or to Division staff for recording, transcription in braille or in any other form; coordination of production; tape duplication; quality control of all braille materials.

TECHNICAL SECTION
Development of designs and specifications for equipment and accessories supplied to readers; quality control of manufactured items; research and development programs for cassette books, cassette duplication and other book reproduction equipment and media.

PROJECT COORDINATION OFFICE
Planning and implementation of automation activities.
Planning and coordination of research.
Direction of contractual activities related to the production of program materials.

OFFICE SERVICES
Maintenance of personnel records; management of fiscal matters; coordination of telecommunications.

PUBLICATION SERVICES
Planning of the Division's information, publications and exhibits programs.

BUILDING SERVICES
Maintenance of physical facilities and equipment; receipt, storage and shipment of equipment, publications and supplies.

NETWORK DEVELOPMENT OFFICE
Responsibility for determining eligibility for service; guidance to and liaison with all cooperating libraries and agencies providing direct service to readers; inventory control of all sound reproducers and allied equipment.

REFERENCE SECTION
Development of the collection of printed materials on blindness and physical handicaps; provision of reference services to staff, cooperating libraries and the general public; collection and dissemination of program data, statistical reports and other current information of interest to libraries and organizations.

MUSIC SECTION
Development of the national collections of musical scores and instructional texts; circulation and reference service of music materials in all formats; encouragement of new techniques and materials for teaching music.

VOLUNTEER TRAINING SECTION
Nationwide recruitment and training of volunteers for the production and processing of books in braille; preparation of manuals and teaching guides for all braille codes; authority on braille codes for the Library of Congress.

VOLUNTEER UTILIZATION SECTION
Coordination of volunteers in all activities which can benefit readers or the libraries and organizations which serve them; training and coordination of volunteers who repair sound reproducers and allied equipment.

NETWORK SERVICES SECTION
National support to cooperating libraries; development of procedures for network participants.

CIRCULATION AND COLLECTION MAINTENANCE UNIT
Circulation of all reading materials in special formats housed at the Division; maintenance of reserve files; card stock distribution and inventory; coordination of excess and want list programs.

RESOURCES COORDINATION UNIT
Network and international interlibrary loan and bibliographic searching services; direct service to readers in areas not served by the network and braille service to States not furnishing it.

March 1975

- Assistant for Library Resources
  Materials Development Office

  - Library Material Needs
  - Shelving and Handling Problems
  - Liaison with Manufacturers and Recorded Edition Suppliers
    - Technical Problems

- Head
  Reference Section

  - Statistics
  - Sources of Demand Surveys
  - Reference Library (Educational)

- Head
  Volunteer Utilization Section

  - Structure of Volunteer Organizations
  - Costs
  - Service Problem History
  - Human Factors Data
  - Delivery
  - Repairs and Maintenance
  - Recording

- Technical Officer

  - Development of Designs, Specifications and Accessories
  - Quality Control Requirements
  - Organization of R&D Programs
  - Instructional Handbooks
  - Cost History
  - Advanced Technology Investigations
  - Manufacturing Sources of Equipment
  - Sources of Media
  - Test and Performance Data
  - Human Factors Data
  - Failure Data (Cassettes and Flexible Discs)

- Assistant Chief for Materials Development
  Materials Development Office

  - Book Selection
  - Magazine Selection
  - Size of Titles Selected
  - Reader Problems
  - Overall Program Needs

- Equipment Control Officer
  Network Development Office
  - Procedures and Control Methods
  - Accounting
  - Inventory and Status Control Systems
- Assistant to the Head
  Office Services
  - Organization Charts
  - Organization Responsibilities
  - Accounting System
  - Budget System
- Assistant for Network Support
  Network Development Office
  - Overall Network Structure and Definition
  - Regional and Subregional Library System
  - Planned Internal Schedule
  - Promotion Schemes
  - Excess and Redistribution System
- Head
  Network Services Section
  - Resources Coordination Unit
  - Circulation and Collection Maintenance Units
- Automated Systems Coordinator
  Project Coordination Office
  - Bibliographic System
  - Data Processing Needs
  - Information Management

2.2 Evaluation of Current and Future DBPH Service Programs

The investigation of the DBPH network consisted primarily of discussions with personnel from the Network Development Office and a review of issued documentation. The contractual scope of work prohibited the research staff from visiting regional and subregional libraries. Contact with readers through the use of a survey system was also outside the scope of work of this contract. During the course of the program, several major areas of activity were reviewed, in order to suggest improvements that will help DBPH reach its chosen reader goals. The recommendations for improvement focused on three specific areas of activity. These are discussed in subsequent paragraphs and come under the following headings:

- Procurement Practices
- Performance Quality
- Information Management System Evaluation

The inputs and outputs of the first two categories of suggested improvements must be documented and input to an information management system capable of being employed by all of the supporting staff members of the DBPH.

2.2.1 Procurement Practices

Each one of the manufacturers and suppliers of recorded editions were critical of the following procurement attributes of the Audio Services Program:

- Awards are made on price only.
- A minimum amount of excess dollars which are needed for technological innovation is not available.
- There is no continuous flow of production activity. This situation necessitates the retraining of production personnel and causes inherently poorer quality control.
- Insufficient requirements exist in the specifications defining the level of quality control or life expectancy.
- Gaps within the specification are sufficiently large to permit the bidders to offer a wide variety of alternatives in technical product design.
- The requirement for the delivery of a first prototype sample prohibits new manufacturers from bidding competitively.
- Insufficient quantities are ordered causing rapid accumulation of excess stock and special facilities.
- The timeliness of the procurements, in relation to their business planning cycles, is inconsistent.

The suppliers of the recorded editions, both cassettes and flexible discs, all seem to be over-capacitated for the amount of work they receive from DBPH, and if they were asked to take on additional large volume production, they would be very capable of doing so. The entire distribution program can be enhanced through both a promotional campaign informing the libraries of the new titles being planned and a stepped-up effort to attract new readers to the program. It was also determined that the current procurement practices for the labels and packages need improvements, for both cassettes and flexible discs. A tremendous penalty in cost is paid by the duplicator for the printed braille labels and the cassette packages which are procured through second sourcing via the American Printing House for the Blind.

It is recommended that DBPH purchase large quantities of standard parts and have them assembled by equipment assembly firms. The logistics and coordination problems of such an effort must be evaluated in relation to the size of the DBPH technical staff. Another alternative is the assumption of new techniques of procurement, using possible cost-sharing methods currently being practiced in other Federal agencies. Target costs can be established, which the contractor agrees not to exceed. The differential costs can be shared by DBPH and the contractor if he comes significantly within the target goal. The stipulation within the specifications that the standard component (or equivalent) can be used will cause most manufacturers (all of those interviewed) to use the standard component.

It was also uncovered in the study that an interesting set of differences in objectives among current suppliers could be employed effectively by DBPH in a carefully evaluated and prepared procurement plan. As an example, it was clearly validated that:

- The American Foundation for the Blind desires that the recording of books be separated from the production of books on recorded discs or recorded cassettes. AFB claimed that they have the capacity to record 500 titles per year and that they would prefer that the award on the recording effort be made separately. If they wished to bid on complete cassette books, they would pick duplicators if DBPH prepared adequate specifications insuring strict compliance by the duplicator.
- The American Printing House for the Blind would prefer to use their studios only if they could get the complete cassette book procurements or flexible disc procurements. However, they will also record master tapes for others, if requested to do so.
- Eva-Tone will gladly respond to requests for duplication only on flexible discs, and they feel that they can be very competitive if DBPH utilizes this type of procurement method.
- Cartridge Control does not have any studio equipment and is interested only in the duplication of cassettes made from the intermasters supplied.

There was a general agreement that the recording studio could supply the master tape as a 2-track 1/4" tape with a recording time of 88 minutes for both cassettes and flexible discs. The tracks could be recorded in either direction and this deviation could be handled easily by the flexible disc supplier.

2.2.2 Performance Quality

The performance of the entire Audio Services Program, when viewed as a complete system, is dependent upon three major factors. They are:

A. Field Malfunction Reporting

B. Maintenance and Repair Programs

C. Reader Acceptance of Quality of Sound Intelligibility Characteristics

A discussion of each of these individual factors follows.

A. Field Malfunction Reporting

A review of the data available at DBPH indicates that it is several years old and a marked degree of improvement in field malfunction data collection and analysis is necessary. The study did not reveal that there were any definite plans for developing such a system and it is mandatory to have such a system in existence for a future analysis to be made effectively.

B. Maintenance and Repair Programs

The review of 1973 surveys seems to indicate that normal maintenance malfunctions predominate and that components seem to malfunction the least. The technical section of this study covers this subject in greater detail. The medium range of malfunctions indicates that DBPH should resolve the reliability problems associated with the cassette/machine interface.

The warranty system is not employed effectively. Volunteers are performing all of these functions today. In the future, when DBPH starts to deliver large quantities of equipment to the field, the volunteers will be incapable of handling the repairs unless their support functions are increased and improved.

It is recommended that the multi-state centers and the DBPH be equipped with the necessary spare parts, test equipment and personnel. Special contracts can be let to firms to perform the maintenance at the multi-state centers covering the four regions of the United States. It should also be recognized that as a result of large purchases of standardized components, the spare parts inventory can be reduced and overall system maintenance can be improved. Through the use of standardized components, a significant reduction can take place in the Mean Time To Repair (MTTR). If the components are of high quality and assembled under good quality control conditions in production, significant improvement in the Mean Time Between Failures (MTBF) can be expected.

A study of the cassette/machine interface indicated that a great deal of the fault may lie with the cassette shell and tape utilized, and it is recommended that extensive reader tests be conducted this year. A review of the current reader survey issued this spring provides the following information:

- It centers around the reader's acclimation to a new type of machine.
- It questions the reader's ability to operate the machine with the printed instructions.
- It focuses on the human factors problem and the reader's ability to handle the controls.
- In the case of cassette or machine malfunctions, it questions the ability of the reader to fix it or to obtain adequate assistance.
- There was inadequate technical emphasis placed on the quality of sound.

C. Reader Acceptance of Quality of Sound Intelligibility Characteristics

During the study, evidence of reader complaints regarding the quality of sound were uncovered. Some complained about the unsatisfactory results they obtain by listening to the new 15/16 ips books. Obviously, their problems are based on two parameters: the frequency and distortion characteristics of the player, and the poor quality of the tapes. The low-to-medium range sounds are probably poorer at the lower speed because the signal-to-noise ratio is not as great. This may be caused by the duplicators who are reducing the modulation level to prevent overloading when duplicating at high speeds. A good recording which is lower in amplitude response at a low-to-medium range is thereby deteriorated by this process. The cassette playback unit seems to have no tone control capability and the distortion of the signal is very apparent - at least in the Waters Conley unit. Bypassing the Waters Conley amplifier through the use of a good quality amplifier demonstrated that a good tape can be played very satisfactorily. Readers complain of a high hiss level and a muffled bass sound. The major population of readers served by DBPH may be hearing impaired and as a result, may have lost their mid-to-high range hearing ability and therefore require more emphasis of signals at the lower levels.

Good, clear speech and intelligible sound are needed and the overall reproduction process must be carefully equalized from the original recording via the equipment to the listener. Quoting Warren E. Sladky in his letter of March 13, 1975 to Mr. Cylke, a case for a more extensive reader intelligibility test and measurement system in the field can be promulgated. He said, "Your goal is not 'hi-fi': It is communication." Therefore, DBPH must dedevelop a subjective test program using test records, scorers and representative readers to improve the response and quality of sound, as heard by listeners.

2.2.3 Information Management System Evaluation

Through the activities and work efforts in the performance of this contract, it was determined that an immediate need exists for an automated information management system in support of a number of DBPH functions. The research team was made aware of DBPH's current efforts toward automation and will present in this section the ideas and recommendations of the kind of system planning which should be initiated.

2.2.3.1 Potential Areas for Automation

A familiarity with the work being performed under contract to DBPH and the findings and activities to date in the development of a bibliographic center was obtained. The DBPH personnel indicated that the following areas are being considered for possible future utilization in some form of automation:

- Inventory control - for equipment and books
- The conversion of musical scores to braille
- Administrative functions
- Volunteer activities
- Research and development
- Publications and information
- Direct service
- Reference

Additional needs for a comprehensive data base and computer system can be discerned from the following types of existing conditions:

a) Of the total population of the United States, 3.7% (7,400,000 readers) is believed to be eligible for direct services of which an estimated 6.5% (480,000 readers) is actually receiving some type of direct service.

b) Many readers are dissatisfied with the number, types and titles of books available to them.

c) Automatic circulation of books frequently results in readers receiving the same book a number of times and titles which are inappropriate to their stated interests and preferences.

d) The entire selection process is performed within DBPH.

e) No standard procedures exist for readers to request the addition of specific titles to those available in any of the media.

f) The machine-lending agencies do not always maintain adequate records of where their machines are sent. The problems created by not having an effective system of keeping an accurate record of all equipment on loan are compounded by the fact that the readers who are currently served tend to be highly transient.

g) Mailing lists are maintained by more than one contractor and are not centralized. DBPH has no single list of the readers it serves.

h) DBPH has minimal contact with the readers it serves.

i) The regional libraries have facilities ranging from no automation to fully computerized services. Some have access to computer facilities, but do not have the technical manpower to utilize them and many libraries have indicated that they would convert to automation if DBPH would provide them with assistance, guidance and direction.

j) The application forms used by the regional libraries are not standard.

k) Surveys of trends in readership characteristics are not made as frequently as the target population characteristics change and they have not always reached a representative sample of readers.

l) Readers of the talking books have difficulty when they move from one region to another because there is no universal reader account number system.

The identification of these problem areas points out a need for a data bank including individual reader profiles and equipment in stock. The equipment handling and title selection procedures, in particular, could be greatly enhanced through the availability of specific information and statistics on the readers' characteristics and demands. Both of these procedures are responsible for providing critical services to the growing number of readers of the talking books, yet the procedures are exclusively manual. The machine-lending agencies each maintain their own records, so that DBPH has no control over their accuracy, completeness or format. The unit responsible for selecting titles to be recorded has no direct channels to the population for whom they are choosing and appears to be too limited in manpower to deal manually with the amount of statistical information that should aid them in their work.

The following suggestions are offered for further study of the benefits of automation in these areas:

A. Equipment Handling

Private organizations are contracted to acquire, lend out to readers and repair the talking book equipment. Especially since the population tends to be highly transient (so that accounts frequently change hands), information should be centralized and maintained by DBPH on all readers and equipment in circulation. Each reader should be assigned a unique code, so that he will not have to re-register every time he moves, and to make it easier to keep track of equipment and reader preferences. The purpose of an automated system to aid in the equipment handling activities includes:

1) The provision of an automated mailing list, keyed by the type of device each reader has and/or the type which he prefers - This list would be updated when a reader changes his address, name or type of equipment, and whenever a reader registers for service or discontinues his subscription. The mailing list would be used for eliciting preferences and comments on both the equipment and the service provided (speed of repairs, quality of machines, etc.) and for notifying the readers of new or modified equipment that is made available and the titles which are recorded for each type of device.

2) Inventory control - Each piece of equipment should have a record on file containing such information as code number, type and model manufacturer, usable or in need of repair, date of production, its current location and its respective machine-lending agency. This would make it possible to have one complete, centralized file at DBPH which could be updated as often as necessary with input from the agencies. In addition, when an agency received a request from a reader for a specific piece of equipment, or needed a replacement for a defective unit, which it did not have available at the time, the file could be queried to locate a unit not in use at another agency. Provisions could then be made for the needed unit to be transferred or exchanged between the two agencies, thereby providing faster delivery to the reader and assuring the maximum utilization of all equipment supplied through DBPH.

   This inventory file could also be interrogated periodically by a program designed to determine such things as whether there is enough of each type of equipment to satisfy readers' preferences, the number of dollars spent on repairs for each type of unit, how quickly defective units are repaired, the accuracy of equipment distribution among the agencies and the requirements for additional or replacement units. The statistical data available from this file would aid DBPH in the future selection and acquisition of equipment.

3) The ability to keep track of equipment - Each record on the reader profile should contain a field for the code number of each piece of equipment on loan to that reader. This would ensure that all equipment would be accounted for and none would become "lost" if a reader moved to another area. It would also prohibit readers from accumulating more than one Talking Book Machine by requesting a replacement without returning their original one, or acquiring any additional machines from different lending agencies.

4) Providing readers with the most appropriate equipment - If each reader's record were keyed on information such as his equipment preferences, his age, his handicapping condition and his living situation (i.e., living alone, in a nursing home, etc.), he could

be assured of getting the equipment most appropriate to his needs and wants. His reading interests could be compared to the titles and subjects available in each recorded form to further satisfy his requirements. Readers should also be permitted to exchange one type of equipment for another, in order to obtain additional books and magazines.

The availability of this kind of information would be useful to the research and development efforts of the Technical Section.

B. Title Selection

It is realized that the selection of titles for production is a complex process which requires the judgment of individuals with a knowledge of the literature available and the needs of the community being served, and it is believed that automation can provide support in the development of the criteria needed for selection. Because the DBPH goal is to satisfy the reading needs and wishes of approximately 1,000,000 individuals in the next five years, with a limited number of books each year, the selection staff should have available to them pertinent statistical data, including:

- the number of requests for each book title and magazine
- the number of requests for specific categories of interest
- patterns of demand for existing titles over the past year
- age, educational, and occupational groupings of readers
- current training and educational pursuits of readers
- titles and subject areas provided by organizations other than DBPH
- the total number of titles in each subject area
- the total number of titles in each subject area, broken down by recording device
- readers' characteristics and demands, broken down by the type of equipment they have, or prefer
- the estimated number of dollars required to produce each title being considered, or per page and type of book
- general public reading patterns (derived from public and university library circulation, best seller lists, etc.)

- quota information, broken down by subject matter category, as well as specific titles and including the format in which the material is to be available

With ready access to such information, the selection staff could devote their time to the more subjective, judgmental aspects of selection, such as literary merit, form of presentation, reputation of the publisher, reviews, etc. Consequently, the number of selection personnel would need to increase at only a very small percentage of the increase in readers over time. The staff requirements would change more with the types and subject areas of materials in demand than with the size of the target population.

To date, excluding requests from Talking Book Topics, only three or four percent of the readers ask for specific titles. This may be due to the fact that they are not aware of any mechanism for making requests and/or do not believe that their requests would be serviced anyway. DBPH does maintain minimal direct contact with readers, so that the readers must rely on their local or regional libraries for making their needs known. More complete, accurate and timely information, relevant to the types of statistics which are listed above, could be gathered through the implementation of standard procedures by DBPH. This information might be channeled to DBPH and entered into the central data bank in the following ways:

1) Reader registration - The only standards currently applied to reader registration are those of certification for receipt of services, according to PL 89-522. The forms used and information collected for registration vary widely from region to region. DBPH should enforce a form for each new reader to fill out upon registering. This form would serve to supply all of the identified data on reader characteristics and preferences to be considered in the selection process. Its format could be either directly keypunchable or machine readable for input to the data bank. Every reader would be assigned a unique identifier code so that a data record could be created and maintained for him. He would then never have to re-register, but simply supply a change of address or change of name notification, as necessary. Upon moving into a new region, the reader's copy of his original registration form would be transferred to his new regional library. This alleviation of effort on the part of the individual libraries would allow them the time to more actively promote their services and encourage participation and subscription by eligible readers.

2) Reader requests and complaints - These should also be standardized for input to the selection process. Forms should be made available at the local and regional libraries (and from DBPH itself), on which readers could request specific titles, express any complaints they have about the services and materials available to them and indicate their areas of interest. Upon receipt, forms

should be designed or screened to separate the data to be input to the statistical data base, for updating the reader's profile record, from comments and information not provided for in the automated data bank, but of potential interest and use to the selection staff. An effort should be made by form letter, or personal contact from local librarians, to encourage readers and their families or guardians to take advantage of this system.

3) Periodic requests from DBPH for information - To further encourage and ensure correspondence from readers, DBPH could periodically mail a questionnaire to either every reader or to those who had not communicated at all since some previous date. Since such a large number of readers would be responding at one time, the form used should be straightforward and fairly simple, to allow easy and efficient input to the statistical and individual data bases.

2.2.3.2 Recommendations for Computer Based Information Management System

The following recommendations are offered as a result of identifying the existing information gaps needed for decisions:

- DBPH should initiate plans for the immediate installation and the implementation of a centralized, computer based, comprehensive system for the maintenance of all relevant data. Information could be mailed, at low cost, from each participating library to the central data base for processing. The complete recommended computer based system could be implemented, at low cost, within months, at a high benefit to both readers and DBPH staff members.

- Current applications for library service should be revised to include questions pertaining to the above mentioned data for new readers and missing data obtained from present readers. Each reader's eligibility certificate could become a part of his machine record.

- A new system would encourage the use of a universal reader account number (e.g., social security number, to be included on the application) and eliminate the reader's problem when he moves from an area served by one regional library to an area served by another.

- Such a system would facilitate the modification of any of the data on any reader, such as changes in eligibility, active status, address, subject matter preferences, etc.

- Maintenance of the above described system would facilitate the tabulation and generation of statistical information representative and descriptive of the readership as a whole.

- Maintenance of the above described system would preclude the necessity of surveying representative samples of the readership population at regular intervals in the determination of general population subject matter preferences.

- Maintenance of the above described system would facilitate general circulation procedures immediately, with special emphasis on the speed with which the reader receives his materials.

- The automatic circulation policies presently in effect at some regional and subregional libraries should be carefully controlled and modified, as necessary, so that the service is provided to only those readers who desire it. In addition, selections should be carefully made according to the reader's particular age group, educational level, expressed area of interest, etc. The recommended computer based system would facilitate the control and modification of the automatic circulation system as it exists.

- It is critical and essential that the DBPH audio services be extended to include a large proportion of the eligible readers - the service is still largely patronized by the visually handicapped only. Therefore, a more widespread and effective promotional campaign, especially in the radio broadcasting medium, should be implemented immediately and the recommended computer based system would become a necessity for the systematic recording of statistics on the growing reader population and the effectiveness of the promotional campaign.

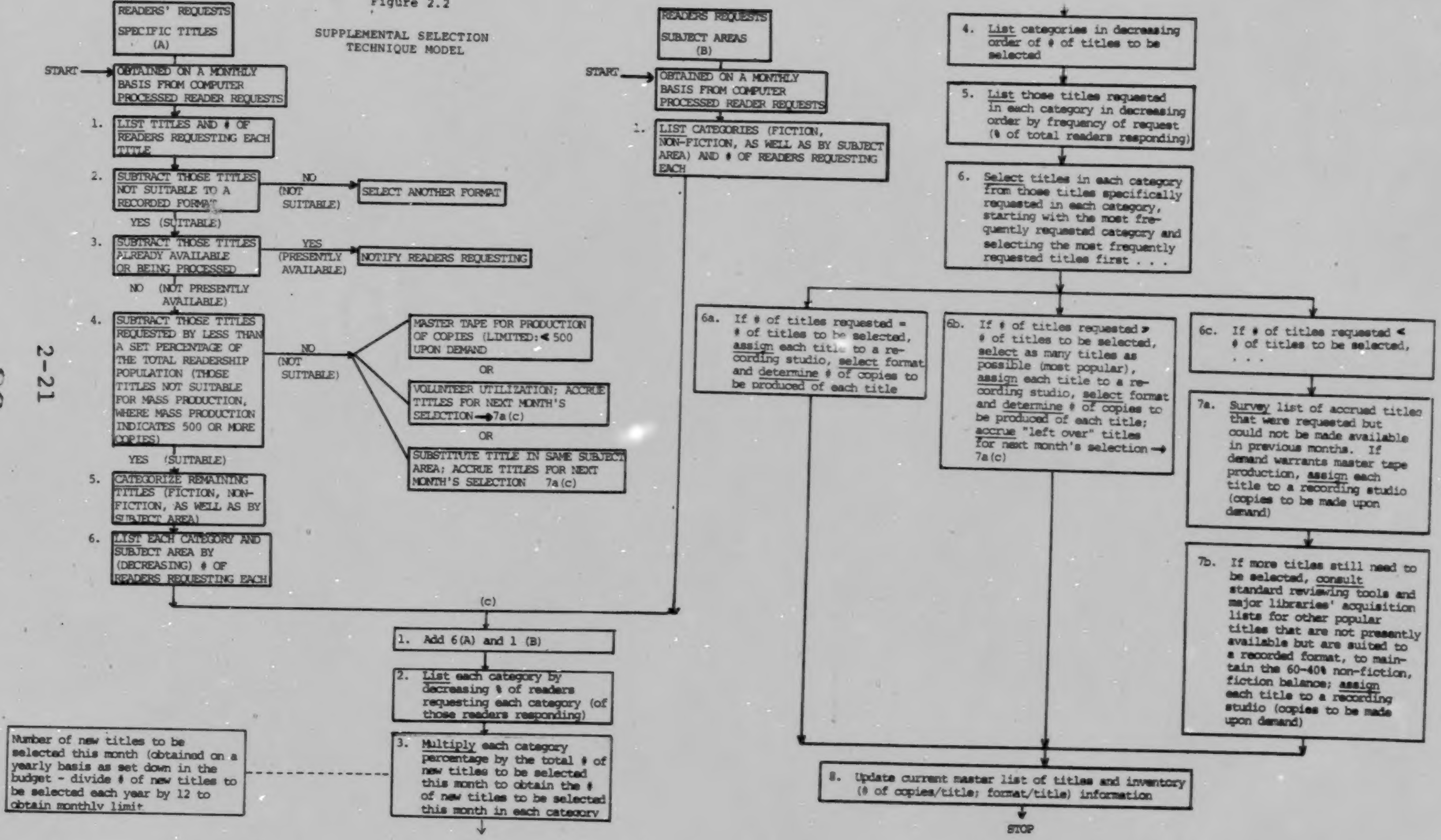
- To the extent that it is practical and possible, it is strongly recommended that the present title selection procedures be automated with respect to readers' written requests for titles or subject matter categories, resulting in a greater dependence upon reader demand than presently exists. While a public library that serves sighted/non-physically handicapped individuals does not employ an automated system for reviewing titles to be included in their collection, neither does such a library serve a population that is as dependent on its services as is the population served by the DBPH network. Ideally, the collection of titles within the DBPH network should exactly match the wishes of the population it serves.

- It is also recommended that request forms be made available to readers at all participating libraries, in addition to such publications as Talking Book Topics. It is conceivable that this recommended system of selection based upon reader requests could be implemented as a one year pilot program that could be terminated, should it prove unsuccessful.

A Supplemental Selection Technique Model (Figure 2.2) could be automated

Figure 2.2

SUPPLEMENTAL SELECTION
TECHNIQUE MODEL


READERS' REQUESTS
SPECIFIC TITLES (A)
START
OBTAINED ON A MONTHLY BASIS FROM COMPUTER PROCESSED READER REQUESTS
1. LIST TITLES AND # OF READERS REQUESTING EACH TITLE
2. SUBTRACT THOSE TITLES NOT SUITABLE TO A RECORDED FORMAT
NO (NOT SUITABLE)
SELECT ANOTHER FORMAT
YES (SUITABLE)
3. SUBTRACT THOSE TITLES ALREADY AVAILABLE OR BEING PROCESSED
YES (PRESENTLY AVAILABLE)
NOTIFY READERS REQUESTING
NO (NOT PRESENTLY AVAILABLE)
4. SUBTRACT THOSE TITLES REQUESTED BY LESS THAN A SET PERCENTAGE OF THE TOTAL READERSHIP POPULATION (THOSE TITLES NOT SUITABLE FOR MASS PRODUCTION, WHERE MASS PRODUCTION INDICATES 500 OR MORE COPIES)
NO (NOT SUITABLE)
MASTER TAPE FOR PRODUCTION OF COPIES (LIMITED: < 500 UPON DEMAND
OR
VOLUNTEER UTILIZATION; ACCRUE TITLES FOR NEXT MONTH'S SELECTION → 7a(c)
OR
SUBSTITUTE TITLE IN SAME SUBJECT AREA; ACCRUE TITLES FOR NEXT MONTH'S SELECTION 7a(c)
YES (SUITABLE)
5. CATEGORIZE REMAINING TITLES (FICTION, NON-FICTION, AS WELL AS BY SUBJECT AREA)
6. LIST EACH CATEGORY AND SUBJECT AREA BY (DECREASING) # OF READERS REQUESTING EACH
READERS REQUESTS
SUBJECT AREAS (B)
START
OBTAINED ON A MONTHLY BASIS FROM COMPUTER PROCESSED READER REQUESTS
1. LIST CATEGORIES (FICTION, NON-FICTION, AS WELL AS BY SUBJECT AREA) AND # OF READERS REQUESTING EACH
(c)
1. Add 6(A) and 1 (B)
2. List each category by decreasing # of readers requesting each category (of those readers responding)
3. Multiply each category percentage by the total # of new titles to be selected this month to obtain the # of new titles to be selected this month in each category
Number of new titles to be selected this month (obtained on a yearly basis as set down in the budget - divide # of new titles to be selected each year by 12 to obtain monthly limit
4. List categories in decreasing order of # of titles to be selected
5. List those titles requested in each category in decreasing order by frequency of request (# of total readers responding)
6. Select titles in each category from those titles specifically requested in each category, starting with the most frequently requested category and selecting the most frequently requested titles first . . .
6a. If # of titles requested = # of titles to be selected, assign each title to a recording studio, select format and determine # of copies to be produced of each title
6b. If # of titles requested > # of titles to be selected, select as many titles as possible (most popular), assign each title to a recording studio, select format and determine # of copies to be produced of each title; accrue "left over" titles for next month's selection → 7a(c)
6c. If # of titles requested < # of titles to be selected, . . .
7a. Survey list of accrued titles that were requested but could not be made available in previous months. If demand warrants master tape production, assign each title to a recording studio (copies to be made upon demand)
7b. If more titles still need to be selected, consult standard reviewing tools and major libraries' acquisition lists for other popular titles that are not presently available but are suited to a recorded format, to maintain the 60-40% non-fiction, fiction balance; assign each title to a recording studio (copies to be made upon demand)
8. Update current master list of titles and inventory (# of copies/title; format/title) information
STOP

with relative ease and alacrity. Modification of any aspect in terms of practicality or applicability to the DBPH program could be introduced without requiring a drastic alteration of the model as a whole.

2.2.3.3 Suggested Methods for Automating

An in-depth systems analysis naturally needs to be performed before the decision can be made to automate any DBPH functions and prior to system design activities. Suggestions of possible methods for implementing the ideas are provided in this section.

An efficient and flexible automated system for DBPH consists of two major parts:

1) An automated library system - As the data bank is developed and updated, all of the information in it should be made accessible to every section within DBPH for analytical, reporting and reference purposes. The use of a word text processor with standard typewriter keyboard entry, unlimited machine-readable storage, simple retrieval techniques and extensive editing and printing capabilities, is recommended. Such equipment is now available in a wide range of costs and capabilities and can be used for both data entry and inquiry by non-data processing personnel. Storage is usually on magnetic tape, which can be used as input to computer programs. (IBM's ATS provides multi-station terminal capability of two-way communication lines to a computer under control of a program that permits a typist to type text into the computer, correct and revise text and have the corrected draft printed.)

2) A computer software system - Computer programs should be made available for more extensive and complex interrogations and analysis of the data. These may be written in-house to perform specifically defined functions, and/or software packages may be installed for data manipulation and statistical procedures. The software that is implemented should allow for extensions and modifications to the data bank at any time.

Four data files have been identified, which should be created initially:

1) The bibliographic data base under development

2) An inventory file for all talking book equipment procured for lending to readers

3) A reader profile data base

4) A reader mailing list (This information may be contained exclusively in the reader profile records or in a separate file for the creation of mailing labels.)

Much of the data collected and stored at DBPH will not be automated in the near future and some documents may never be computerized. This data should also be included in the overall library system, so that all sources are made available to each user in the most efficient way possible.

In order to accommodate the quantities and different types of data and the various forms in which they will be collected, an operational system should be designed which provides cross references among the different data sources and will service the following types of information handling characteristics of a program, such as the one being recommended:

- Much of the data collected will need to be reduced in bulk.
- Users of the data bank will ask for information in a variety of ways.
- The types of information and terminology in the document collection may change and expand frequently.
- Information will be stored on a wide variety of subjects.
- Users' needs will be complex, in that they will require precise information and will frequently want to be able to correlate or manipulate same.

All of the information sources, both hard copy and soft copy, must be linked together in such a way that anyone with access to the data bank can cross-reference all of the available information they require. Coordinate, or correlative, indexing can accomplish this by employing large numbers of short terms which describe the various subjects, features, characteristics, etc., of each item in the library. Both broad and narrow terms are used, which range from precise words and quantitative or qualitative data to abstract concepts. The index is a separate, highly manipulative file that is searched by selecting those index terms which best describe the information that is desired and then referencing the document, or file record, numbers listed under them.

Correlative indexing can be provided either by manual methods and equipment, or by utilizing mechanized equipment. The system which is implemented must be chosen on the basis of cost, size of the data bank, the types and forms of stored information to be indexed, the number and skills of persons with access to the data, the average daily extent of storage and retrieval activities, and the search capabilities desired.

Two of the manual indexing systems which require no special skills of those using them, and which may be appropriate to the needs of DBPH are:

- Permuted indexes - These are specially printed and organized manual indexes which are usually prepared by a computer from document titles, full text, a catalog or index entries. Some of the types available for adaptation are: KWIC (Keyword in Context), KWOC (Keyword out of Context), WADEX (Word and Author Index) and

SPINDEX (Special Permuted Index). The major advantages are their relatively low cost, speed and ease of preparation, ease of revision and highly meaningful and browsable entries. The major disadvantage is the probability of searching problems created by inconsistencies in word usage.

- Dual dictionary systems - All indexing terms and document numbers are printed on two identical lists mounted side by side. The user looks up those terms that describe the information for which he is looking and notes the document numbers recorded under each one. A dual dictionary is usually maintained and updated by computer. It is best suited to situations where there are many users in different locations.

The following are examples of the types of machine indexing systems which are currently available:

- EAM (Electrical Accounting Machine) punched card systems - Such systems utilize punched card files in two general ways: 1) the preparation of one or more cards per document or record, to identify the source and its assigned indexing terms, and 2) the preparation of a separate card for each indexing term assigned to each document. While such systems are flexible and manipulative, their accessibility is limited and correlative searches of them are slow.

- Computer index searching systems - These utilize manually prepared indexes, arranged by document number or indexing term, which are coded and input to a computerized file. The index file is referenced via computer and complete descriptions of those records which satisfy the search requirements can be immediately obtained. The provision of statistics on the frequency of use of each indexing term in both indexing and searching, and the frequency of cross referencing terms can be programmed as an aid in evaluating and modifying the system in use. The thesaurus of indexing terms and any reference aids for users can also be produced by computer.

- Computer automatic indexing and searching - "Full text" systems utilize computer programmed instruction for indexing and searching. Complete titles, text and bibliographic data are input to the computer. The computer chooses the non-common words as indexing terms, according to a "stoplist" provided of common words which are not to be included. A reference number is listed for each location of a term in the text. Some of the numerous searching techniques which can be employed are set theory concepts, word frequency counts and the specification of the proximity of one term or another.

Extensive documentation is available on each of these methods. Checklists should be used for comparing the capabilities and impacts of each one considered within the requirements of the DBPH library system. The library system should be used to feed information to the computer programs and also serve as a backup system through which alternative methods of data analysis can be made if the computer system ever breaks down or proves to be inadequate. In order to serve these functions, the following interfaces should be established between the two systems:

- Data sheets should be formatted, indexed and coded on the word text processor in preparation for computer input.
- The information stored on the word text processor should be indexed and cross referenced for easy retrieval of parameters with specific characteristics for computer input.
- Any questionnaire forms should be formatted for direct input to both the library and the computer system.
- The library indexes should identify the basic information sources for certification of computer input.
- The library cross references and the automatic retrieval methods should facilitate manual data analyses for backup and verification of the computer programs.
- The computer system should provide continual feedback to the library system in the form of:
    - the identification of incomplete, inconsistent and missing information and codes
    - the results of statistical analysis, to be stored in the library for reference and report preparation
    - programmed modifications and rearrangement of data

The automation of information which is recommended in this section could be accomplished in stages - perhaps starting with one regional area at a time. The data base on equipment and equipment handling functions might be initiated with data from those machine-lending agencies which tend to keep the most accurate records of their activities and inventories. In the development of support for title selection criteria, procedures should be tested and initially established through those regional libraries that already have their own EDP equipment and whose staffs have some expertise in and understanding of automation. The availability of TWX in a library would facilitate the process of transferring data to DBPH. Those libraries that have access to computer facilities or are planning some form of automation, should also be included in the planning and developmental stages, so that they can adapt their system designs to the standards set by DBPH, and provide input which is in a form most directly usable.

Once DBPH's system is made operational, provisions should be made for submission of machine-readable data formats from those libraries and agencies with EDP capabilities. Technical assistance, guidance and direction should be continually provided to those libraries in the process of becoming automated, as their progress will enhance the overall functioning of the national system.

SECTION 3

DESCRIPTION OF SITE VISITS

3.1 Introduction

DBPH required and arranged visits to a total of six suppliers who produce materials for DBPH and two potential suppliers. These included visits to record/tape manufacturers and to equipment manufacturers. The description of the information exchanged during these visits is contained in the following paragraphs.

3.2 Description of Site Visits to Record/Cassette Tape Manufacturers

A. The American Printing House for the Blind was visited on 3/12/75 and 3/13/75. The following personnel were interviewed:

- Finis Davis, Vice President and General Manager
- Glenn Scheurich, Head of Talking Book Department
- James Medley, Engineer, Talking Book Department
- Wayne Brown, Production Engineer

A tour of both their engineering and manufacturing facilities was provided. Discussions took place on the following subjects:

- improved product assurance and quality control
- attitudes toward recording and mass production of discs and cassettes
- the compatible subassembly purchase concept
- their ability to assemble new equipment designs for DBPH
- their available capacity
- their facilitation costs
- their suppliers of key components
- their attitudes in regard to material shortages

With regard to quality control, APH indicated their belief in buying good components. If DBPH wishes to use the capacity of their recording studios, they would prefer to use their facilities to produce large quantities of flexible discs or cassette tapes. Surplus capacity is available, and APH would like to receive the large orders; however, they would be willing to take the low quantity production or master taping, as well. They felt strongly that servicing DBPH by providing studios for master taping is only a by-product of their mass production capability.

APH depends on using Phillips Films Co., Inc., a subsidiary of Phillips Petroleum Co., for their supply of raw elastotherm vinyl stock. APH can take raw resin or even pellets and come up with their own raw stock if necessary. They prefer to buy the manufactured vinyl raw stock. They indicated that by paying a good price to their supplier and being a good customer, they can avoid problems in the event of a future Arab oil embargo.

APH uses polyvinyl chloride (PVC) for both flexible and rigid discs. There are two substitutes for vinyl (dependent on the use of petroleum products) for the rigid disc; these are polypropylene and polystyrene. Polypropylene is higher in cost and has poorer recording characteristics and polystyrene has poorer wear characteristics as well as poorer recording characteristics. Neither of the two compounds is usable with the flexible disc. There is a modified PVC compound available; however, it would not prevent the embargo problem.

Due to the fact that the flexible disc requires PVC at approximately $1.00 a pound, which is more expensive than the regular vinyl resin ($.33 a pound) currently used in rigid discs, APH believes its supply will be assured in the event of an embargo. They also claim that the higher the planned DBPH production rate, the more guarantees can be provided to their raw stock supplier and the likelihood of the supply continuing will be greater.

APH currently buys the following components:

- raw stock
- cassette plastics
- labels
- splicing tape

For their equipment, they buy all the parts and assemble their own phonographs. They purchase cassette players from GE and Sony. Their estimated cost for their cassette facility is $250,000. The breakdown includes the following:

Studio	=	$ 40,000/each
4-Track Recorder	=	$ 3,000
Ampex Loop Bin	=	$ 35,000
Three Slaves	=	$ 15,000/each
Loaders	=	$ 8,000
LP-36 Label Printer Modified for Braille	=	$ 7,700

The remainder of the expenditures are in the physical plant, air conditioning, and humidification.

The interview team observed three studios. APH's flexible disc plant can print up to 315,000 discs per month, and they estimated that they can compete with Eva-Tone in producing large quantities. They use the label printer LP-36, which is modified for braille, in both the cassette and record manufacturing process.

In the review of changes to equipment specifications, APH expressed an interest in the new concepts presented. They believed that they could assemble all of the compatible subassemblies efficiently if these subassemblies were described in the specifications as "or equivalent." They indicated that they would purchase only the standard subassembly recommended by DBPH for cost reasons. During the meeting, a mutually-derived, rough-estimated price for the use of standard subassemblies purchased in very large quantities, to be assembled and tested by APH, was prepared. The table below identifies the projected costs:

Subassembly	Cost
Case	$ 8.00
Amplifier	6.00
AC Motor	6.50
Turntable-Cassette Assembly	12.00
Speaker	2.00
Lateral Cartridge/Arm	6.00
Assembly and Test	10.00
	$50.50

They recommended a good cassette deck made by the Economy Company called PHI-Deck. Brochures and prices obtained on this cassette mechanism after the meeting indicated that four AC motors are used and the price is extremely high. APH stated that the variable speed control feature is used by their target population and they plan on converting to variable speech control using compressed speech circuitry very soon. They envision that a massive purchase of automatic speech control hybrid circuit boards could reduce the price from its present $150 value to $10. Students seem to prefer the capability of speeding up or slowing down the reproduced sound. Variable speech control is conceded to be better because it provides more intelligible speech at the higher and lower speeds.

APH used AC variable speed control in a Sony open-reel recorder and changed the frequency of an oscillator in the inverter. They claimed that DBPH, in experimenting with AC motors, tried unsuccessfully to change the voltage for variable speed control. As a result of this action, DBPH chose a DC motor. Varying the voltage of an AC motor does not change its speed effectively. They demonstrated their experiments with the 4-Track World Book Encyclopedia using two button control and indexing tones on each track. The machine counts at 20 ips and allows the reader to return to a prior reference in accordance with the counter, which is included in the equipment.

B. Eva-Tone Soundsheets, Division of Eva-Tone, Eva-Type, Inc., was visited on 3/19/75 by ISR and DBPH Staff Member, John Kozar. The following personnel were interviewed:

- Richard Evans, President
- Laurence Johnson, Director of Marketing
- Norman Welch, Director of Manufacturing
- Rudy Savage, Recording and Sales
- John W. Ball, Sales

The meeting was established to evaluate the following factors attributable to Eva-Tone's manufacturing:

- their production capability
- their quality of recording
- their estimated costs for flexible disc
- their suggestions for the improvement of the entire Audio Services program

In a review of all of the aspects of their entire process, a model prepared as a result of the visit to APH during the preceding week was evaluated. This model specified the costs of magazines that were being issued on a weekly, monthly, and bi-monthly basis. Eva-Tone went through their listing for all flexible discs and identified the following range of disc quantities per magazine:

Weekly - 2 discs/magazine

Monthly - 1-4 discs/magazine

Bi-Monthly - 2-4 discs/magazine

Information was provided that Ranger Rick and Jack & Jill required one disc and Atlantic and Harpers required four discs. The monthly magazines ranged from two discs for Retirement Living to four discs for Good Housekeeping. The only weekly magazine was Sports Illustrated. This new information was inserted into a revised financial model.

A price list was established to reflect the anticipated costs. The following table identifies the information provided:

Quantity Proposed	Number of Discs per Issue	Total Unit Cost Including Packaging, Labeling & Mailing List Update
500	no quote available	---
1,000	2 (Magazine not identified)	$ .47
2,000	1 (Jack & Jill)	$ .36
4,500	2 (Retirement Living)	$ .30
10,000	2 (Sports Illustrated)	$ .50

The impact of a lighter turntable on the disc quality was discussed as well as the impact of a lighter tone arm with an improved, sharper stylus. Eva-Tone felt that at 8-1/3 rpm the lighter turntable, which would not be affected by the torque of a new AC motor, would be very acceptable; however, the question of tone indexing arose.

Eva-Tone claimed that the current specifications for a tone index at 100 cycles at 8-1/3 rpm requires the reader to skip rapidly to 33-1/3 rpm to find the location change. The change from 8-1/3 to 33-1/3 and back again without vibration occurring is required. If the arm jumped a number of grooves, it would cause the reader to have problems in locating the next article. DBPH requires the selection of articles by a factor of four times the speed for tone indexing. Both APH and Eva-Tone did not realize the value of indexing for readers. If the 33-1/3 rpm speed requires a higher torque motor, then the momentum problem may not allow for a lighter turntable.

There is also a question as to how many of the 33-1/3 rpm hard discs will be in use during the transition period. If there were no requirement for 33-1/3 rpm (either due to the removal of the indexing requirement or the lack of use of 33-1/3 rpm recordings), then there would be no effect on the quality of recording produced for the 8-1/3 rpm flexible disc.

It was agreed that a lighter tone arm than the currently specified Astatic model "A" tone arm using a plug-in, retractable cartridge is desirable. This approach would protect the stylus and, to a lesser degree, the record. Flexible discs are not adversely affected by scratches. With the type of reader that the Audio Services Program addresses, this tone arm concept may be more desirable. The impact of a sharper diamond stylus (.0005") as compared to the currently specified .0007" may be more desirable with the lighter flexible disc. It would also provide more recording time.

With the 17 gram (.0007" stylus) tone arm, it might be possible to get more playings. With a 10 - 15 gram tone arm using a .0005" stylus, 50 high quality playings may be achievable. This high quality would be obtained by using a stylus more compliant to the groove cut in the record. Since the quality is dependent on the record cutting procedure, a new type of groove is needed for the sharper needle. The flexible disc manufacturing process will not be affected; however, the recording time may be reduced. The three play requirement in the specifications for the flexible disc is obsolete. Eva-Tone believed that 125 playings could easily be obtained with a slight deterioration in quality at 80 playings and over. They also recommended that the sponge should be centered carefully on the turntable.

A discussion of the interface specifications required between the supplier of discs and the provider of master tapes occurred. It was established that the 9" disc is the most desirable from a manufacturing cost point of view. Eva-Tone prefers the 9" disc because it gives them the optimum use of material. The smaller the disc, the poorer the quality of the recording. The sharper stylus requirement on the cartridge could provide 77 minutes of good quality recording. A frequency response test at 4000 cycles conducted previously could not meet the specifications. Testing at 1000 cycles is more suitable. The current 60 minute requirement could be raised to 75 minutes per side at reduced frequency response, or the 60 minutes could be retained for better response at the end of the recording.

Eva-Tone recommended that any interface specifications of the master tape be compatible with both the flexible disc and the cassette duplication process, and that the following specifications be used:

- 7-1/2 ips Recording Speed
- 1/4" Acetate or Polyester Base Tape
- 7" or 10" Reel
- Monaural - Full Track or 1/2 Track
- Frequency Response 30 to 10,000 hz ±3 db
- Recording Time - 88 minutes

Eva-Tone indicated that AFB and APH could record for 88 minutes, and Eva-Tone would then cut and edit one side for 60 to 77 minutes depending on the stylus being used in a record player. Equalization can be accomplished by the recording engineer for the type of sound desired.

A 1/4" 2-track tape would be acceptable to Eva-Tone if both tracks were recorded in one direction or two directions. If it would be necessary for them to replicate discs for magazines, Eva-Tone would require the tape 7 to 8 days after receipt of the print edition. Eva-Tone also recommended an R&D program on a new book and large magazine package and has submitted several ideas in the past to DBPH for evaluation.

A recommendation was made to have the mailing lists updated on a computerized system available at DBPH, in order for the price to be reduced for direct circulation. Eva-Tone also stated that based upon their estimates for current readers, they can provide one magazine for every reader (1:1) through direct circulation as compared to the current rigid disc ratio of 1:3. The cost per year for this entire program was estimated to be $560,000.

It was recommended that DBPH should estimate an average of three discs per monthly magazine. Their estimate for a 9" disc was approximately $.10 a disc for a quantity of 10,000. Their three studios could be very useful in getting weekly magazines out on time. If AFB, APH or their facilities were saturated, other recording studios could be used. For magazines, they felt that sufficient capacity was available at all three organizations.

Information was also obtained from them on their cost/volume ratios for flexible books. They felt that six 9" flexible discs were equivalent in recording time to two C-90 4-track cassettes. They claimed that they could produce a disc book (over 5000 in quantity) at $.66 and with packaging and mailing included at $.85. The equivalent cassette book would cost roughly $2.90. It was estimated that it would cost $.40/disc for quantities of 5000 rigid discs, at three discs per book, or roughly $1.20 plus packaging and mailing costs.

The characteristics of the recorded sound were discussed, and Eva-Tone stated that at 8-1/3 rpm the quality of frequency response varies from the outside of the record to the inside of the record because the distance the needle traverses (at constant speed) becomes smaller as it approaches the middle. This reduces the response characteristic, and it was claimed that, if good frequency performance is specified for the outside, it will be better on the inside. Accordingly, a low quality recording will produce a worsening response as the needle moves inward.

A recording characteristic curve comparable to RIAA quality might be an improvement over current DBPH specifications, which would require a frequency response of 6 db of the reference level between 200 and 4000 hz at a constant velocity above 500 hz and constant amplitude below 500 hz. Eva-Tone also commented about the requirement for alternate readers which they feel is unnecessary and affects the frequency responsiveness of the recording. They have assumed that the DBPH reason for this requirement is the need for a method of indexing by using a different voice. Therefore, in recording six articles, the voice would be alternated three times over a two-hour period. The current frequency response tests are run at 1000 hz at one of the outer bands. They stated that claims made that the quality is the same at the beginning and at the end are only subjective opinions.

A review of Eva-Tone's production cycle indicated that it was similar in methodology to what was described at APH; however, they claim to be able to handle 100,000 copies per disc master as compared to APH's estimate of 10,000. These figures appeared to be inconsistent; however, the following was discovered:

The master disc is first made from acetate lacquer. This is called a "female groove." This master is converted into a metal "male" master through an electroform or electroplating process. It is then converted to an electroplated female stamper (groove in). More than one stamper can be made from one master disc and one stamper can generate 10,000 good pressings, except when poor quality PVC raw stock renders the stamper inoperable. The visit to APH indicated that they do not replicate masters and therefore, consider 10,000 a breakeven point for high quantity production. In the opinion of Eva-Tone representatives, one master can readily produce 100,000 copies with no cost penalty.

Regarding available material supply, Eva-Tone reports a good business relationship with Phillips Petroleum. Eva-Tone uses the same elastotherm vinyl raw stock used by APH, paying a price penalty of $1.00 per pound. In the event of an oil embargo, they expect Phillips to continue their supply on the preferred customer-preferred price principle. They encourage the particpation of other suppliers so that the basic raw stock price may be reduced. In their opinion, a quantity purchase by DBPH may attract other suppliers, such as Dupont.

C. Cartridge Control Inc. was visited on 3/26/75. The following personnel were interviewed:

- Donald Comstock, President
- William Evans, General Manger
- Jerry Appling, Chief Engineer

Cartridge Control is a cassette duplicator company which provides 15/16 ips 2-track cassettes from intermaster tapes received from DBPH. The visit centered on discussions involving the problems associated with the use of cassettes, including:

- machine problems
- cassette-shell problems
- tape problems

Cartridge Control uses high quality tape manufactured by BASF and 3M. It is a Polyester tape and does not contain PVC. Differences exist in the tapes used in C-60 cassettes as compared to C-90 tape cassettes. There is an "experience feeling" that C-60's are far more reliable; however, no measurable data is available as to how much more reliable they are. In the examination of a 3M specification, the following significant differences were noted:

	C-60 Cassette	C-90 Cassette
Thickness	.68 mils	.48 mils
Yield Strength	1.7 lbs/.150"	1.0 lbs/.150"
Breaking	3.0 lbs/.150"	1.8 lbs/.150"

The obvious technical differences indicate potential problems. It was reported that there are difficulties inherent in using the lighter C-90 tape, both at the supplier's plant and at the cassette duplicator's plant. Cartridge Control uses a C-0 cassette. The difficulties can be summarized as follows:

- the need for more extensive quality control procedures, especially when using the .150" width and in trying to meet the .000" to -.002" tolerance on splicing
- slitting problems, especially in regard to the tolerance specified
- coating problems
- the assembly of the tape onto pancakes
- the mechanical tolerance required on all supplier machinery
- the need for careful winding of the tape on the hub to avoid flaws
- the unavailability of economical C-90 tapes

It was affirmed that if a C-90 program were desirable, DBPH should specify the types, or equivalent kinds of tapes to be used. There is a decided advantage in specifying the tape in that competition would tend to be equalized and low bidders would be prevented from using low quality tape.

Cartridge Control stated that the most significant problem in the cassette-machine interface is in the choice of a standard C-0 cassette. The two companies which supply their C-0's are Data Packaging, Inc., and Shape Symmetry, Inc. An examination of the internal construction of the Shape Symmetry cassette revealed that it does not meet DBPH specification. It has a felt pressure pad attached permanently to a plate and roller guides which are seated in a well, with no steel pin used. Cartridge Control's experience with this type of cassette shell, however, has been good.

They were also pleased with the cassette C-0 shell made by BASF, using precision guides or snap arms that tend to provide trouble-free operation. Other shells which they favored were the Maxell C-0 which provides a quiet, loose, and free running characteristic; the Philips Norelco which incorporates a felt-sponge permanently adhered to a shield type of pressure pad; and the 3-M cassette which uses fixed posts. The best C-0's, purchased in large quantities, are available at unit prices ranging from $.13 to $.16.

Cartridge Control indicated that a buyers market currently exists for high-quality, well-tested cassette shells. Samples of a clear plastic shell without windows were provided during the visit, and it was mutually agreed that such a cassette might be used advantageously in that libraries and volunteers would be able to inspect them more easily. They are not as aesthetic as the solid gray ones, but could be more beneficial to the overall program.

The next subject discussed was the potential use of screws in place of thermoplastic welds. Cartridge Control felt that if the cassettes were repairable, the use of screws would be desirable and that the only possible cost disadvantage would be a $.02 difference in price. There have reportedly been significant problems in the welded construction in regard to tolerances. Cartridge Control validated that they would prefer a standardized C-0 specification from DBPH in order to achieve improved economies of scale and competitive practices. The subject of leader-to-tape splicing was discussed and they claimed that they usually provide a smaller tolerance (negative) to insure adherence to the .150". They preferred that the corner-pin roller be a flange roller tape guide with a stainless steel pin. They reiterated the point frequently made that if a disc becomes scratched, it can still be a usable recording; however, if a cassette were to fail, the book would become useless.

Additional information obtained on the C-90 and C-60 cassette diferences indicated that a C-90 takes 422 feet of tape, while a C-60 usually takes only 295 feet; therefore, a C-90 is considerably heavier than a C-60. Cartridge Control also indicated that it is difficult to detect a problem in advance, detection sometimes taking as long as six months. They also stated that if 10,000 Brand X type of C-0's are made, only 100-200 out of 1000 malfunctioning units will be discovered. Although they have absolutely no test equipment available for measuring the quality of the C-0's or the tape used, they indicated that the current DBPH use of an obsolete Philips Standard is impractical.

The problem of the high cost of labels and packaging was also discussed. For duplicating a cassette book, the cost is $1.50 for the book and $1.50 for labeling and packaging. A standard package produced by an outside firm is less expensive than one purchased through APH. Coronet Paper in Carlstadt, New Jersey, provides the printed braille labels. If Cartridge Control could be assured of larger and more continuous production runs, they could obtain their own printing unit. It might be more economically convenient if DBPH provided the printed braille label through an automated system. Cartridge Control also recommended that additional human factors studies be conducted on the label.

During the factory tour, several significant differences were noted between the quality control procedures used by Cartridge Control and those at APH. The procedures are similar except that Cartridge Control utilizes an aural test of the pancake and a run-in test to check hub and tape binds after the King Loaders are used. Neither of these tests is performed at APH. They do not, however, test leader-to-tape splice, adhesive or cassette torque, as APH does.

As part of the tour, the inferior reproduction quality of the Waters Conley cassette player was demonstrated with a high quality tape. When the tape was tested on the Waters Conley unit, a considerable degree of audio distortion was produced and the tone control was ineffective. The amplifier was then bypassed and a signal was fed from the Waters Conley pre-amp directly to a better amplifier, resulting in a tremendous improvement in the intelligibility of the cassette itself.

D. The American Foundation for the Blind was visited on 3/27/75 by ISR and DBPH Staff Member, John Kozar. The following personnel were interviewed:

- Loyal Eugene Apple, Executive Director
- Alfred Lisi, Associate Director
- Peter E. Hanke, Engineering Director
- William Howle, Production Manager, Recording Studios
- John Breuel, Director, Talking Books

The visit with AFB centered around the following key subjects:

- recording characteristics
- ideas about equipment performance
- concepts regarding the reliability of cassettes
- future plans

A general agreement was reached early in the meeting that "equal performance" was both necessary and achievable for a high voice intelligibility system if the sound reproducer more accurately compensated for the recording characteristic generated by a high quality professional studio. The following data, generated in 1964, were provided:

1. 8-1/3 rpm reproduction characteristics comparing A (effective characteristic) and B (system frequency characteristic), recorded at 16-2/3 rpm speed.
2. Record Amplifier Response (Ampex)
3. Playback Amplifier Response (Ampex)
4. Amplifier Adjustment Range Characteristics
5. Crossover Network Characteristics
6. Characteristics of Equalizers

This is the first instance of technical data obtained from a recording studio on how the DBPH specification of "good sound" for voice is met. Claims of good sound had frequently been made without definition. It was agreed that paragraph 3.5.4 of the Cassette Book and Duplication Specification (15/16 ips) is a subjective test.

In evaluating their curves, it was determined that from 3000 to 5000 cycles AFB reproduces the system characteristics very accurately. At 8-1/3 rpm, they roll off quickly past 5KC, which for voice is very acceptable. At 5-3/4", they provide 3 db of emphasis, thereby supporting their high frequency response; and at 8" from the center, they provide an additional 2 db of emphasis. Their response curve appears to be very good for voice intelligibility.

Paragraph 4.1.1 of the A-75 Talking Book Machine Specification requires the use of an AFB Standard Frequency Test Record for testing an amplifier's frequency response. This test calls for the following: "At 200 hz the output with respect to the value measured at 1000 hz shall not be down more than 15 db." It was agreed that this amplifier specification would make the low frequency response very poor since the recorded characteristic is down 7.5 db already at 200 hz. At the high frequency (the specification calls for not more than 10 db), this could be too high since the record characteristic is +10 db. It would require a significant roll-off to get a useful tone control, especially since paragraph 4.1.4, which specifies tone control action, does not specify the roll-off in terms of db/octave, only specifying the frequency to be 2000 cycles. It was therefore concluded that improved specifications are needed to match the software to the hardware in order to achieve a high quality intelligible voice system.

The recording characteristics of the Flexible Disc (8-1/3 rpm) Specification No. 75-112 were reviewed, and the problem of using constant velocity as a specification was discussed. Even though it is a standard method to employ constant velocity, it does present a problem in that the response changes as the stylus moves closer to the center, especially at 8-1/3 rpm, because the distance traversed is shorter than at the edge of the record.

If a modified constant velocity characteristic were to be cut, there would be some groove cutting problems associated with the mechanical restriction of the record, the needle, and the speed of cutting. Trade-off's would be the sharper stylus, a large flexible disc, and the physical dimensions of the grooves.

The problems of the hearing impaired reader were also discussed in terms of a study conducted by Dr. David McGowan of the University of Connecticut for the Veterans Administration. The study indicated that in a group of 225 blind persons ranging in age from 20 to 75 years, with an average age of 47 years, only 10% had normal hearing. Normal hearing was defined as a bilateral capability less than 20 db loss in either ear. The study utilized standard audiometric tests which are generally not positive in identifying hearing impairments in that they do not accurately define hearing loss in borderline cases.

During discussions of their future plans, AFB provided the following information:

1. They would like to evolve something new.
2. If they were not competitive in quality or in price to flexible discs, they would close down their production line to serve the best interest of DBPH.
3. They would like to produce high quality recordings and master tapes.
4. They would like to subcontract to cassette duplicators if DBPH were to revise their specifications.

They did not feel that they could compete in price with the flexible disc. It currently costs them $2.50 per book, minus packaging and labeling expenses. They felt that purchases of 1000-2000 books were ideal because their best cost/volume ratio has been occuring at those quantities.

During the commentary on the C-60 versus the C-90 issue, the Chief Engineer indicated that the C-60 was more reliable by virtue of its stronger tape and the ease in handling the tape during the duplication process due to the lesser winding tension pressures. He indicated that the specification of the cassette presented the key problem. Upon examination, the Norelco digital cassette and the Maxell cassette appeared to be excellently constructed. Although Maxell, a Japanese firm, has refused to sell C-0 cassette shells, AFB's experience with 100,000 C-90 Maxell cassettes has been excellent. The Maxell unit uses screws, which appear to be better than the use of a thermal-weld binding because they allow for:

- field repair
- less squash
- better dimensionality

AFB also recommended that random sampling be conducted periodically for a new DBPH cassette shell. They recognize that a C-90 can produce a two-cassette book as compared to a three-cassette book using a C-60 cassette. Also, if proven to be economically reliable, the C-90 would be the best cassette to use. They predicted that there would be a 10-20% failure increase of C-90's over the C-60's; however, they were not able to prove that the higher failure rate would be due to the tape as compared to the C-0 used. At this time, they use and recommend the creased slip sheet liner which is being used by Maxell and which provides:

- a concise wind
- a static discharge capability
- a reduction in friction

They also recommended that an advisory committee be formed and that the work of the American National Institute of Recording, Committee X3 b1, composed of cassette and machine manufacturers, be investigated. In addition, it was mentioned that the Bureau of Standards has been very active in providing cassette testing for GSA.

3.3 Description of Site Visits to Equipment Manufacturers

A. Waters Conley Co., Inc., was visited on 3/18/75, and the following personnel were interviewed:

- James McFarland, Assistant General Manager
- Paul D. Mohlke, Materials Manager
- William G. Holtorf, Manager of Quality Control

Waters Conley staff were queried as to the penalty in cost caused by improved quality control procedures. It was indicated that a high range of malfunctions in the physical interface between the cassettes and the playback heads of the machines occurred. There were no members of the engineering staff available at the meeting and the only production line being used at the time was the one devoted to the TBM.

The Waters Conley personnel suspected that a large extent of cassette failure was due to the basic cassette shell. They commented that no failure data was available to them on either machine failure history or reader complaints and that, without such data, it was very difficult to identify what production changes were required. They stated that they have received information on problems with the C-73 machine which have included cassette-pop-out, head alignment and spillage problems. They estimated that tape spillage malfunctions were reported about 35% of the time and that tape jams in the capstan were also commonly reported. They had also heard of complaints about the battery, and felt that the battery charge should be checked out before the readers obtain them. Apparently, the readers do not plug the machine into the AC outlet to recharge the battery before use.

They commented that it is difficult to innovate because the cost competition for the units does not leave much room financially for their company to perform research and development. The competition prohibits their using any initiative in making new design changes. They also felt that the DBPH specifications needed improvement. They did not, however, have significant data available to indicate just how poor the specifications were because of the insufficient information on equipment field malfunctions.

The concept of employing mass purchasing of standardized components was was discussed, and Waters Conley pointed out that, if they bought boards (loaded from overseas vendors, they could obtain several significant improvements over their current amplifier board. The loaded board, in contrast to the purchased component assembled board, has the following economic advantages:

- It is assembled free and tested.
- The component life may be longer.
- It has improved reliability.

Comparing the two concepts, the individual component board requires dollar for dollar more manual production activity on their part, as well as a greater usage of quality assurance controls. If a common amplifier loaded board were used, significant savings could accrue to the manufacturer of the completed equipment. It would be of greater help to the program if it were made in the United States because mechanical parts are also currently being made overseas. During the discussion concerning reader susceptibility to change, Waters Conley expressed the belief that the transition should be made from the hard disc to the flexible disc and then, gradually, to the cassette.

The combination machine is a good concept because, if produced at a low cost, it would solve the transition problem more easily, and would also service multiple readers of different types of recorded materials.

Reader and volunteer complaints about the packaging concepts currently used were discussed. It was felt that a new reusable package could be designed for the program. On the subject of quality control, Waters Conley felt that they exercised good quality control and operated within the Mil Std-105 (10%-AQL Level 2.5) limits. Unfortunately, this could not be witnessed on their production line. The following problems were in evidence:

- Torque tests are performed by a manual touch test.
- In-process inspection is inadequate.
- There is no full time inspection on the line.
- Units are packed and sent to storage in considerable quantities before the in-process inspector arrives. A large number of rejects, especially on torque measurements, were found when the inspector conducted the tests, in comparison with the number rejected by the production line testers. This form of infrequent inspections lends itself to considerable problems.

Waters Conley indicated that their production lines could handle up to 500 units per day, and that, if they had a full time inspector available at a cost of $40.00 a day, it would cost the company less than $.10 a unit. Presently, forty units out of each 500 are sampled for the final inspection tests. The units are taken out of the line prior to the sealing of the packages. This test, which is conducted in a separate quality control room, has the following deficiencies:

- The final package is not completely checked.

- The serial number of the unit is checked against the contents versus the shipping list.
- The procedures are exactly the same as the last test performed on the production line.
- The inclusion of all the instructional literature is checked in the case, but not in the final package.
- The torque test is again performed by a manual touch technique, and there are no specifications for doing it otherwise.

A review of their factory test procedures indicated that they only tested what DBPH required as a minimum. DBPH should improve their specifications in order for the factory to conform more closely to the engineering performance requirements for the subassembly. Waters Conley admitted that motor manual tests should be specified for motor torque.

Improved test procedures are needed for incoming material inspection as well. They did not have adequate data available on their amplifier's performance because the data specified on their test sheets seems to be inadequate. They felt that if DBPH could specify better test procedures, documentation requirements, and the frequency of testing, the overall program could be improved. They recognized that the 2-year warranty was not a sufficient requirement and could be more costly to them if there were a significant increase in the problems encountered in the field. They do run a life test where 12 amplifiers are changed daily and are run for 24 hours. They also run 12 amplifiers for 500 hours while the amplifiers are being built and assembled.

They felt that they have the capacity to build 950 units a day on two production lines using an 8-hour shift. If they had continuous production procurements, they could improve their quality control procedures considerably. They have the capacity and the facilities to handle 5 distinctive production lines. Obtaining trained labor would be their most significant problem.

Their quality assurance organizational structure is designed not to allow their Quality Control Manager to report to their Plant Manager. He reports directly to the Telex Corporate Product Assurance Manager. They reviewed the costs prepared for a combination unit and indicated that a $55.00 cost level was accurate. They felt that their overhead would bring it up to a $90.00 sales level. They indicated that they quoted $98.00 at sales for their previously designed unit and felt that, with a large production buy program of standardized units, they could significantly reduce the price, possibly approaching $75.00 per unit. The large purchasing power would permit them to obtain:

- a low cost design (utilizing innovation)
- efficiency in manufacturing (one set-up per year)
- quality improvements

- a more efficient line - with less retraining and rehiring
- the amortization of much of the current overhead costs

They saw no reason for the use of a DC motor in the cassette machine but also recommended the idea of using an injection-molded turntable. They estimated that this component could be obtained at $.50 a copy in large production quantities. The group discussed the problem of providing good voice intelligibility to the readers. They recommended a program of conducting intelligibility tests with the readers. If a "good quality" sound could be defined, then a standard speaker and amplifier could be designed to match the acoustical properties of the case. This would solve a great number of problems when it comes to matching the manufacturer's equipment to the recording characteristics produced by the studios.

B. Interstate Industries was visited on 3/20/75. The following personnel were interviewed:

- Jerry Rissman, President
- Howard Kovin, Executive Vice President of Sales
- Randy Rissman, General Manager
- Edward Jacobson, Head of Engineering
- William Palisek, Head of Design

At this meeting, a discussion transpired on the problem of the lack of innovation in the current engineering practices of the manufacturers, as well as the question of "What Price Quality Control?" Interstate Industries claimed that the DBPH practice of lowest cost procurement and the first prototype sample at the time of bid openings prohibits their ability to offer innovation. They indicated that they have to be very precise in their pricing and, as a small firm, they cannot afford very much R&D. They felt that the 7-year spare parts guaranty and the 2-year warranty programs are unrealistic. They would like to see the "known cost" principle applied which allows them to cost share any overruns up to maximum with their customer.

They reviewed the interviewer's pre-prepared cost model completely and agreed on the mass procurement buy concept; however, they felt that they should buy the qualified components because they could do it cheaper than DBPH. They felt that a combination unit could be built for $55.00 at cost and that with a markup of 15% for overhead, they could sell it to DBPH at roughly $75.00, which would include profit.

They perform a fairly comprehensive on-line inspection procedure starting at 100% incoming inspection, and then they perform the in-process line inspection using electrical performance measurements. They do not believe that good quality assurance procedures are a significant amount of the costs and are a prerequisite for good manufacturing. The tour of their plant exhibited this capability.

They demonstrated a new cassette player assembly which allows the cassette to go in through the side. It visually seemed to be well designed and they said that they were expecting a research and development procurement from DBPH soon. They have essentially an assembly operation which operates on a low overhead basis because of the large scale production of other commercial equipment for Radio Shack, Sears, etc. During the technical discussions, they agreed that improvements could be made in the amplifier and speaker specifications, as well as improvements through the use of a lighter tone arm and lighter turntable. They recommended the investigation of an injection-molded turntable which would be dependent on the torque drive of a new motor. They estimated that such a turntable could be procured for $.50 each, in contrast to $1.75 each.

The company provides Mil Std-105 final inspection tests at a 10% check (AQL Level 2.5). Their amplifiers are more state-of-the-art than the Waters Conley units and they have had considerable success with 2.5 watt amplifiers made out of integrated circuits. Their amplifiers are made for commercial music quality with a frequency of response of 60-15KHz.

3.4 Description of Site Visits to Potential Suppliers

A. The Harman Kardon Company, was visited on 4/1/75. The following personnel were interviewed:

- Leonard Rosenblatt, President, Amilon Corporation
- Robert Greenberg, President, Harman Kardon Company
- Robert Brody, Director of Engineering, Harman Kardon Company

This meeting was devoted to the idea of examining the interest and capability of Harman Kardon and Amilon to be potential suppliers to DBPH of the cassette or combination machine. Amilon manufactures a high quality cassette deck for Harman Kardon at a cost of $65.00, exclusive of controls or case. Their machine currently utilizes two AC motors. They use the General Industries motor specified by DBPH. They use the GI motor for the reel motor and they purchase a small AC motor from Matsushita. By having two separate motors, they feel that they are avoiding the clutch problem inherent in a one-motor machine. The clutch problem creates further problems in the use of normal cassette shells which they have experienced to be unpredictable and unreliable. However, they admitted that the Maxell C-90 has never given them any problem, and if cassette plastics were reliable, there might not be the need for the second motor. For their institutional higher-priced market, they are trading more heavily on reliability as compared to economy. Because the cassettes exhibit friction problems, they decided several years ago to use the two motors.

Harman Kardon was very much interested in the potential size of the DBPH market and was unfamiliar with the business risks they would be taking by virtue of a government R&D procurement. They have always been used to providing R&D on their own and not making their ideas available to potential competition. They indicated that they would like to review their own corporate posture in order to ascertain if the "special product" nature of this market warranted a change in their thinking. They technically reviewed the common motor assembly concept of the combination machine and believed it was a good one if cassettes were reliable.

B. Hitachi, Ltd. visited ISR, Inc. Corporate Headquarters on 4/2/75. The following personnel were present at this meeting:

- Jim Y. Narita, Sales Manager, Advanced Products Div., Hitachi Sales Corporation of America

- Tatsuo Takeuchi, Manager, OEM Business Department, Hitachi, Ltd.

Discussions were held on the use of Hitachi's TSC-8800 Tape Recorder with a Talk Speed Control Function. They had indicated that in their meetings with DBPH, there was an interest expressed in the concepts of this unit. This unit has a Talk Speed Control Switch which permits the change of tape speed in nine steps. For compressing sound, they have a 4 step control system (1.2, 1.4, 1.6, and 2.0); for extending sound, they have four steps (.8, .7, .6, and .5) and one standard step. They use twin AC motors, one exclusively for reproduction and one motor for reel rewind to improve efficiency. This entire unit is very expensive, costing about $475.00. They have both record and playback features and use digital and delta modulation techniques for the speech compression and expansion. The unit employs a frequency converter that keeps the frequency during reproduction the same as during recording. Their tape speed during reproduction can be changed as much as +100% to -50% without tonal change. A listening test verified that their sound quality is better than the current speed changer mechanism utilized by DBPH; however, it could still be improved in the future. Hitachi was shown the GE cassette player and recognized quickly the different type of equipment needed by DBPH.

The combination machine was discussed, and Mr. Takeuchi demonstrated how he would mechanically link the units together. He also used a separate winding for AC conversion on the AC motor. They sketched out how they would accomplish the design, and their ideas matched in concept with the technical recommendations made in this report.

Hitachi indicated that they are very much interested in bidding on the cassette player being procured by DBPH in May, and they believe that they can meet the domestic requirements. They also stated they are very interested in doing preliminary design work on the combination machine.

SECTION 4

DETAILED TECHNICAL ANALYSIS

4.1 Problem Identification

The results of this study clearly indicated that a significant improvement in technical leadership is needed in the Division for the Blind and Physically Handicapped in order to achieve the degree of technological innovation required to improve the quality of performance of both the equipment and recordings made by selected DBPH contractors.

During this study, a significant amount of information was uncovered on general and specific problems that must be corrected if DBPH is to achieve its short and long range goals. This section first highlights some of the general problems presented and then identifies the specific technical problems to be addressed during the conversion program.

4.1.1 General Problems

There is a need for an overall program of specification revision which reflects the innovative new ideas of current manufacturers, as well as the current advancements in technology.

- The need exists for a comprehensive test program involving components, equipment and reader reactions to the intelligibility of the recorded sound.
- A significant proportion of the manufacturer's equipment dollars is currently allocated to overhead and not directly applied to the cost of the DBPH project. The current manufacturers must be made to recognize the "special product" nature of the DBPH market and should not develop their technical performance specifications simply by improving the product designs beyond their previous commercial requirements.
- During the site tours, it was recognized that there is almost full acceptance of the idea of compatible subassemblies - tested and qualified by DBPH as a means of developing the requisite large purchasing power needed to meet a 20% increase in reader growth. This will reduce the overall requirement for spares at multi-state centers. If the suppliers can be used as assemblers - which, in fact, they are now - they can, if the production rate is high enough, develop innovative approaches to new design problems. This should also contribute to price improvements because of the natural competitiveness of the commercial marketplace.
- It is believed that a significantly lower cost Combination Machine purchased with common parts is economically attractive and achievable. This will also provide a benefit to the readers of both maga-

zines and books. This unit can be built to meet dimensions that permit the unit to be portable so that it may be placed on top of a table at a hospital or other institution. It is believed that the Combination Machine would attract low overhead assemblers who would be capable of inserting the necessary product quality assurance at minimal cost to the purchaser.

- The compatible parts principle can also be employed in units, such as a Revised Talking Book Machine and a Revised Cassette Book Machine, which should significantly lower the costs of these units, as well.

- In order to achieve all of its goals in the technological area, it is necessary for DBPH to retain the services of consultants or to establish a job position for a high level, broad-based Chief Engineer who can reorganize the engineering and test facilities at DBPH to specify, test and evaluate the performance of suppliers and their products.

- Procurement and logistics practices at DBPH may require change and they need to be investigated in depth. Several alternatives need to be explored. These include:

  - Purchase by DBPH of large quantities of subassemblies and the administrative and logistical support to distribute the subassemblies to manufacturers who have the capability of providing assembly operations.

  - Special procurement procedures - whereby the manufacturers work to a target cost, and cost-sharing incentives are employed if they exceed target costs. If DBPH was to use the "or equivalent" concept, then manufacturers would have a tendency to purchase the standard subassemblies.

4.1.2 Specific Technical Problems and Recommendations

As a result of the analysis of the equipment specifications and the validation of new technical recommendations by visits to the suppliers, the following technical improvement suggestions were derived:

- A study and test program should be initiated by the DBPH Technical Staff on a recommended specification for a high quality Cassette Shell Plastic C-0 type. Several vendors, such as Maxell and Superscope, produce "plastics" that seem to have excellent performance characteristics, but do not meet the Philips Standard. The Philips Standard needs revision to include more detailed testing and performance requirements. It is also understood that Philips has a revised and improved standard for a 1-7/8 ips cassette, but has not acknowledged the need for a 15/16 ips specification.

- It is recommended that a unified program be established for developing an "equal performance" capability of an entire acoustical system. This starts with the original narrative recording, the duplication (via cassette or flexible disc) and the response of the typical reader's ear to a highly intelligible voice. As a result of this effort, DBPH can establish good specifications for:

  - a highly intelligible voice amplifier
  - tone and speech distortion response
  - cassette and flexible disc reproduction characteristics
  - speaker performance
  - case configurations
  - recording characteristics

  This may require a specifically designed reader intelligibility scoring program, using test records, volunteers and score sheets.

- Manufacturer claims of "up to 250 recordings" on flexible disc should be tested, not in a controlled experimental environment, but under field conditions. Only then can it be assumed that flexible disc books are usable and can be recirculated amongst readers.

During the site visits, very preliminary specifications were used to exchange technical ideas with members of the engineering staffs of the various companies. As a result of these discussions, several ideas for further investigations were provided, as summarized below:

- The use of a lighter tone arm with a sharper stylus and a plug-in cartridge is recommended. In addition, the tone arm should permit the reader to move the arm in such a manner that the stylus is raised so that scratches of the record or, specifically, damage to the stylus, does not occur. The damage to the stylus is far more significant than record scratches. The choice of weight of the tone arm and the dimensions placed on the stylus must be based on trade-off studies made on 1) human factor problems, 2) fidelity of sound reproduction, 3) the ability of the flexible disc supplier to record the information, and 4) the breakage and cost of the stylus.

- It is also recommended that an investigation be made of a new compatible AC motor (2 pole) with a special, double-insulated, separate winding with a 14 volt center tap which can be rectified to 9 volt DC to operate the amplifier. This will eliminate the use of a separate isolation transformer and still provide protection to the reader. The use of an AC motor drive in a cassette machine can provide ample torque when, and if, friction were to build up in the cassette shell. The present DC motors, because of their size, are limited in torque drive.

- Due to the high cost of nickel cadmium batteries presently used, a new, low cost, rechargeable battery should be investigated, such as Gel Cell (improved, lead acid battery). The equipment provided by different manufacturers should also be investigated because it is reported that they currently provide for different recharge cycles and create reader complaints.

- The investigation is recommended of a new high voice intelligibility amplifier using a complimentary symmetry-output stage into a capacitive load, as compared to using an output transformer. The power output should be significantly higher, in order to avoid distortion; the frequency response of both the amplifier and the tone control should be configured to provide a flatter response over the intelligible voice range with significant roll-off at the higher frequencies. Also, additional emphasis should be placed in the low-to-mid frequency range. Provisions should be incorporated into the pre-amplifier for the use of automatic speech control circuits (when available) and for the current automatic speed control units presently in existence. Apparently, every reader does not desire automatic speed control.

There is an obvious need for tighter amplifier specifications for frequency response and distortion to match the requirements of the recording curve to the response characteristics of the amplifier. A high frequency response amplifier may not be necessary because it would provide a high degree of audible scratch noise. It should be recognized that current amplifiers exceed the specifications now in effect. If music is to be played, a good 200 - 5000 cycle frequency response will provide adequate listening for the user.

- In developing the compatible parts concept, consideration should be given to eliminate the battery or the automatic speed control unit as part of the case assembly. Such auxiliary units should be available upon request by the special readers.

- A possibility of a lower cost turntable should be examined. The following factors should be investigated:

    - material selection
    - cost vs. performance
    - reliability
    - weight of the arm, record characteristics and the speed of the turntable
    - surface conditions and vibration possibilities
    - motor torque and flutter problems

- The investigation of the use of a compatible cassette and mechanical turntable assembly, independent of the motor and capable of being connected to a common AC motor, is recommended. The use of a new type of cassette machine, with the side of the cassette being inserted, instead of the flat insertion mechanism (as currently being employed in the CBM manufactured today), is also recommended.

- The investigation of a small, highly intelligible voice quality loudspeaker system for use in all of the machines currently available should be made, in order to prevent the loudspeaker from deteriorating the positive effects of a good amplifier, cartridge, recording head and stylus design.

- A combination case, small in dimensions so that it can be portable and employed in institutions, should be designed. The use of the narrow side for both the speaker and a new cassette insert is also recommended. The cassette mechanism connected to a turntable (as offered by Interstate), seems very feasible.

- A study and test program should be conducted on a low cost way to package both cassette and flexible disc books, and the use of packaging consultants is highly recommended.

- The study of the use of the flexible disc for highly popular books is recommended, if the test playings (as suggested previously), reader acceptance and the availability of a low cost package result in achievable improvements. If the price and availability of suppliers of PVC are examined carefully, the new flexible book medium may be very attractive.

- An investigation should be conducted of the C-90 4-track cassette and a 9" flexible disc as the standards to be employed because they provide the least cost per amount of recorded time. A comprehensive reader field test of the C-90 cassette is necessary to affirm its reliability, before a firm decision can be made.

In addition, it is recommended that a study be initiated to determine the optimum intermaster to be used for specifying the interface between the initial studio recording, the cassette duplicator and the flexible disc supplier. Proper specifications will provide a well integrated cassette and flexible disc supply system among the following DBPH program participants:

- Professional Recording Studios
- Volunteer Recording Studios
- Cassette Duplicators
- Flexible Disc Duplicators

Changing the 88 minute recording time is not recommended because the capability of editing and equalizing the recorded signal exists at the control console used for cutting the master disc. If a C-90 turns out to be unreliable, this ground rule might change.

There is an obvious need for an improved product assurance method of controlling the manufacturers through the revision of technical specifications to include:

- the specification of the test of the standardized compatible subassemblies including a demonstration of equipment operating life

- the inclusion of an MTBF figure and the demonstration of the performance of the equipment to meet this figure
- the inclusion of the requirement to provide documented test data and the results of quality assurance testing
- the specification of the types of tests and the test schedules and the inclusion of periodic sampling tests to demonstrate the manufacturer's compliance with the first prototype model
- the revision of the spare parts list required to provide the right amount and type of spares for the technology provided at present
- the requirement of plant access and witnessed environmental tests by government quality control inspectors at both the prime manufacturer's and vendor's plants

4.2 Equipment Specification Analysis

After the evaluation of the DBPH specifications for both the TBM and the CBM, the following recommendations were derived. If DBPH decides to use the compatible subassemblies concept of procurement, then a new case design is needed for the three units which will be used. These units are identified in the following manner:

A = Talking Book Machine

B = Cassette Book Machine

C = Combination Machine

The dimensions of the case should be as small as possible to enable readers to employ the player on bedroom or hospital/institution tables and other small surfaces. For Unit A, the suggested dimensions of 14" x 11" x 7" should be sufficient. For Unit B, smaller dimensions can be used instead of the size now employed, which is 11" x 9" x 4". For the Unit C, the estimated size is 14" x 11" x 7", although a layout of the mechanical components is required for confirmation. Such dimensions assume that the smaller speaker opening will be on the narrow side of A, B and C and in configurations B and C, the cassette would be inserted through a narrow side, sidewise. The speaker can also be in the cover of the A and C units, if a better quality speaker is desired.

A high impact plastic, with characteristics of Cycolac ABS-GS, is largely satisfactory for the case because it is widely used in handy-talky radios which are currently in police service. Various improved materials are now available also. The case should have an attached carrying handle, made of plastic or metal, to permit easy handling and the bottom surface of the case should have attached four (4) large diameter "suction cups" to permit the unit to be used on smooth table tops without the sliding off problem. Units A and C should carry a hinged, lift-up cover to protect the tone arm and turntable when not in use. Unit B should have a snap-fastener, retained, removable cover. The covers should contain cleats to permit the winding up of the line cords or adapter extension cords. A line cord of at least 8' should also be included.

The cases should contain slots in the side walls and possible deck to permit some movement of air for ventilation. Provisions for batteries and future automatic speech control circuits should also be provided. It is also understood that the Underwriters Laboratory has recently changed their specification on case materials for fire protection reasons; this change should be investigated.

The power transformer should employ the use of double insulation between the primary and secondary windings, in accordance with the latest standards for medical electronic devices to afford protection against shock hazard. The line switch should be a separate switch - not integral with the volume control, to avoid the necessity of the reader to reset the volume control.

The frequency response of the amplifier only, feeding a resistive load, should be plus/minus 1 db with respect to the 1000 cycle level from 400 to 3000 cycles. The level at 300 and 5000 cycles may be -1 db. A poorer specification than this is unnecessary because any simple amplifier is inherently flat from 300 to 3000 cycles. The 5000 cycle high frequency response is needed because such response usually falls off as readers age. The roll-off contributed by the tone control above 2000 cycles plus/minus 10% is acceptable, but it should be as rapid as possible and should be approximately at 6 db per octave. This could be the reason for the lack of effective tone control in the Waters Conley unit, as well as complaints about high frequency hiss or scratch from elderly readers. The frequency response at the 300 cycle portion of the amplifier should be emphasized to compensate for the loss in the recording characteristic at a minimum gain of 3 db per octave. This can be readily accomplished using RC components.

After a good amplifier response is obtained into a resistive load, the next problem is the choice of a suitable loudspeaker and baffle arrangement to reproduce the most intelligible response as accurately as possible. The lows are a function of the speaker's size and baffle. The present cassette loudspeaker has a cone diameter of approximately 3" and has a resonant cutoff of approximately 150 cycles. The problem is further aggravated by the lack of a suitable baffle to adequately load the speaker even down to its low frequency cutoff. The high frequency response is largely blocked by the molded plastic grill, which appears to have a sound transmissibility of less than 20%.

The maximum power output handling capability of the amplifier should be increased to 2.5 watt maximum. In order not to overdrive the output with this increased volume capability, the circuit design implemented must prevent this from happening. If reduced high frequency response (as previously discussed) can be tolerated, lower distortion will also occur. With this type of amplifier design (again into a resistive load), a distortion specification of 5% at 400 mw would be more lenient for the hearing impaired reader and fairly inexpensive to obtain. The speaker system must also be designed to accommodate this increase in signal amplitude.

A compatible amplifier is recommended for the cassette book, flexible disc and combination playback machines. This requires a range of input level from .2 mv (cassette) to 300 mv for the disc, and the provision of this capability has a minor influence on the cost of the amplifier. It is also recommended that no output or input transformers be employed and that an output stage using complimentary symmetry be considered, which will provide a minimum amount of DC drain on a battery. A completely connected plug-in board and the availability of a terminal connection in the preamplifier for connection to an externally automatic speed or automatic speed control circuit is needed.

The manufacturer should make maximum use of integrated circuits, and the entire amplifier can be built on a circuit board approximately 2" x 4". This board will also include the required rectifiers and filters needed to provide the 9 volt DC with minimal noise. A standard, high quality, small loudspeaker should be provided for a nominal output of 100 mw and for one watt maximum. This loudspeaker shall be capable of operating with minimum distortion over the passband of 300 to 4000 cycles and at 200 and 5000 cycles.

Paragraphs 4.2.1 in Specifications A74 and A75 for the Talking Book Machine require a 4-pole motor. The same paragraphs in Specifications C74 and C75 for the Cassette Machine require a 9 volt DC motor. An AC motor is inherently constant speed and speed changing is mechanically controlled. A DC motor requires electronic speed control and employs brushes, which are troublesome items. For commonality, the use of the same AC motor is urged with the speed change for cassette drive being obtained mechanically. An external motor control potentiometer can be employed to change the speed of the AC motor when operated in the cassette mode, using a battery. It is recommended that a standard 2-pole AC motor at 10 watts maximum with a specified speed regulation of +4% to -1% be used.

Specifications C74 and C75 require a Battery Power Supply. A battery inverter can generate 117 volt AC - just as well as an AC rectifier system can generate DC. This configuration is desirable, since all AC version undoubtedly is used in most instances and it would be undesirable to provide a penalty for the minority of equipment. The nickel cadmium battery is excellent, but it is expensive. The new sealed Gel battery is less costly and may be equally good for this service where minimum weight is not a requisite. If a detailed investigation proves that the battery/inverter combination is not economical, it may be recommended that the combination does not include portability for the small percentage of readers, but be made operable on AC line only.

The motor assembly should be grommet mounted, in order to reduce mechanical noise. If case resonance amplifies the noise, some lining material, such as Cellotex, can be used. If such resonance is likely, then there should be an adjustment of the case dimensions which have been suggested. A standardized turntable-cassette assembly is recommended for the combination machine. This should contain a mechanically operated control lever capable of permitting the selection of either 33-1/3, 16-2/3, or 8-1/3 rpm speeds of the turntable. Another mechanically-operated control lever should permit selection of tape speeds of either 1-7/8 ips or 15/16 ips. This will include a

4-track head cassette system as well as a turntable and its associated turntable drive. The cassette subsystem shall be assembled on its own back plate and be suitable for being mechanically integrated with the disc subsystem which has, in turn, been mounted to the AC drive motor. A belt and idler pulley should be used to deliver rotational drive from the motor spindle to the cassette subsystem, and noisy mechanical gears must be avoided.

It is also recommended that a compatible tone arm and cartridge assembly be built as ruggedly as possible without overloading the needle pressure. Emphasis should be paid to the "float" hinge design so that the arm cannot be lifted free of its pivots. The use of a protective arm design equivalent to that developed by APH or commercial manufacturers should be considered with a plug-in cartridge. Radial travel stops should be included which cannot slip set screws. A "parking" support clip should be provided for holding the tone arm when it is not in use. Seizure should be sufficiently tight to hold the arm during shipping. An improved stylus, which should be more compliant, is necessary and the arm should protect the stylus from being inadvertently broken. The malfunction or breakage rates of the sharper needles must be checked.

The equipment should be designed to meet high reliability standards rather than least manufacturing cost. The total "Cost of Ownership" including the original manufacturing cost, shipping costs to repair centers, shipping costs back to user, repair parts and, principally, the repair time will offset the increased cost of highly reliable equipment. NASA and Military high-reliability standards are not required since the equipment will probably be used only in a "shirtsleeve" environment. An investigation may show that ordinary MIL circuit components will give the desired longevity since they far surpass ordinary commercial performance; however, no such standards exist for loudspeakers and motor drive assemblies. Accordingly, extensive life testing will be necessary to demonstrate that the latter have the desired life performance, especially where improvements are required in mechanical subassemblies. We recommend demonstrated life expectancy tests of 2500 hours in duration.

The equipment should also be designed for maneuverability and for the ease of maintenance. It should be modularized in such a manner that any module or mechanical assembly can be revived and replaced without the use of a soldering iron. One printed circuit board should be employed for the amplifier and the power supply. The board should carry a connector which can insure the desired contacts without requiring an occasional plug-in and plug-out requirement for cleaning. Mechanical assemblies to the speaker and the tone arm harness should carry inexpensive bayonet connectors, and an ample margin of consumer safety criteria should be built in. Heat sinking should be used and electrolytic capacitors should be of the metal case, glass insulator type, adequately supported and not hanging by their leads. All paper roll capacitors should be metal cased and glass insulated. A line fuse should be included and a few spare fuses furnished in an envelope with each unit. Directions should be included for using them.

Failures will occur on equipment, which must be returned to a repair station. The reader will not be able to adequately pack the equipment for return so that further damage may result in transit. Some form of reusable packing should be designed, so that when the equipment is removed from the carton, the packing can be unfolded and tied into a flat package. The reader should be instructed to store and reassemble the package when (and if) there is a need to return the equipment. Instructions on how to repack the unit should be included in the Users Instruction Book. This is an urgently needed item. Likewise, repair bases have no packing material and often repaired items are received by readers in a smashed condition.

In addition to the original "Qualification Test" which the manufacturers perform and which the DBPH verifies, periodic samples should be selected at random for requalification. The frequency of such tests should be scheduled in the contract. On multi-year contracts, this item is often disregarded. Repeat orders for parts by manufacturers are not always placed with the same vendors. Changes of assembly personnel sometimes changes the standard assembly techniques. The higher the reliability desired, the tighter the individual piece inspection should be and the more frequent the qualification test should occur. Plant access, reporting of changes in quality control procedures, the documentation of tests and the conducting of new environmental performance tests are recommended. along with an improvement in the requirements issued currently by DBPH for finished product testing.

4.2.1 General Design Considerations

In the interest of designing for reliability and lowering cost, emphasis should be placed on the elimination of parts. On straight AC models, the use of a power transformer can be avoided by employing an overwind on the drive motor. A half wave power rectifier saves a silicon diode with a slight increase in filter capacitors. The use of inexpensive feedback (R&C) components can improve the response of an inferior speaker. The use of integrated circuits, such as the Motorola MFC 6070 and GE PA-234, can save interstage coupling components. The designer should use as low a DC voltage as the circuit will tolerate to reduce heat and voltage stress. The use of plastic bonding to hold all components to the PC boards - both for strength and for heat conduction - is required. A pilot light could be included in the unit, even though it is of no use to the reader. This would provide an indication to an attendee that the unit has been left running.

Although the use of PC board construction yields the least expensive initial cost, the use of terminals for interconnections is better for servicing, so that components can be removed more easily and failure traces can be made easily. All assembly screws should use Loc-tite, since there have been reports that many screws vibrate out of place.

Three configurations of the Flexible Disc and Cassette Book Machines are recommended:

A = Talking Book Machine

B = Cassette Book Machine

C = Combination Machine

A and B are the standard configurations which have already been produced and in the future will make maximum use of standardized, compatible subassemblies. The configuration for C goes even further and combines the mechanical drive systems with a single motor, and the cost saving can be considerable. A decision to eliminate the portability requirement for this unit will reduce the need for an inverter and the need for batteries. However, if the reader normally is furnished machines for both cassettes and records, C can introduce a problem. If the C amplifier fails, the reader can play neither the cassette nor the record. The same situation exists, however, when any reader is provided only one machine.

4.3 Maintainability and Product Assurance

4.3.1 Cassette Malfunction Analysis

One of the major attributes of measurable reader satisfaction is the availability of equipment and recorded editions. This section provides a review of what was learned regarding the reporting of malfunctions of machines, flexible discs and cassettes. The only information available in written form was recorded in 1973, being the "Interim Report - Cassette Damage - - Field Survey" and "Cassette Machine Repair Survey," both dated October 3, 1973. The survey which was based on cassette machine reports was submitted to DBPH from repair centers covering the states of Colorado, Georgia, Montana, Maryland, New Jersey, Virginia, Western Pennsylvania (Pittsburgh) and the District of Columbia. A total of 2770 cassette readers were surveyed; a total of 164 machines were repaired, which is 6% of the machines surveyed. The only significance found by reviewing this data is that it demonstrates the following levels of maintenance activity:

Level	General Description	Specific Malfunctions
Highest	Normal Maintenance	cleaned and lubricated; battery recharge; no trouble (reader erroneous complaint); adaptor repair; tape jam in capstan; pinch roller
Medium	Machine Cassette Correlated	tighten take-up assembly; replace head; soldered connection; cassette-machine interface
Lowest	Equipment Correlated	component failure

In the cassette damage field survey conducted, seven regional libraries were asked to physically inspect returned cassette books for damage. Only four usable reports were obtained. The only significance of this survey is that in a total book count of 1903 books, cassette damage estimates ranged from a high of 24.6% (199 out of 810) to a low of 9.7% (80 out of 825). Defective book cassettes missing ranged from 2.4% to 5.6%. There was also a great indication that readers were not flagging the damaged cassettes. This data leads us to believe that the most significant problem exists between the cassette plastic and the playback heads. Some problems are caused by the cassette itself and some are caused by the machine.

Interviews with DBPH Technical Staff provided information that malfunctions have occurred in cassette plastics where pressure pads have been found to fall out. The question as to why this was not visible to manufacturers indicates that maybe 100% inspection should be required. This need for improved quality control was also supported by the claims that loose windows were found in the cassettes. Static flashes were also claimed to be encountered on the magnetic tape as it ran across the playback machine heads. The lack of slip sheet liners for draining off static charge was also questioned, as well as the accumulation of debris in the cassettes.

There also seemed to be differences in the location of the print and braille on the recorded material. Tone indexing has been missing. This is an audible tone at 100 hz which is -18 VU down. Excessive gaps in the recordings have also been found, as well as tape loops. DBPH gave a contract for conducting tests on the internal construction of audio tape cassettes to Continental Testing Laboratories Inc., Fern Park, Florida. The final test report was issued on February 28, 1974. This report was reviewed and it provided information that new testing procedures and a tighter specification for cassettes are needed.

Suppliers were asked about the additional penalties in cost they incurred, in order to provide the quality or product assurance necessary to minimize reader dissatisfaction, created by machine or recording media malfunction. A summary of the key information learned is provided below:

- There is no continuous flow of equipment, which is necessary to provide stability in the production line. The cyclic nature of the small scale specialized procurement requires retraining and does affect the quality of the product.

- Predicting the future production load is a severe problem. The problems of a non-profit organization are more severe than those of a profit-making organization. APH purchases their amplifiers and uses components readily available because of the severity of the price competition. Concentrating a good part of the investigation on the malfunctions that have been encountered by the reader indicated that there was no data available at DBPH and there was sufficient reason to suspect poor visual inspection procedures. This existed at both APH and Waters Conley.

- APH and Cartridge Control both purchase cassette shells (plastic) and they buy a C-0 type unit. They are phasing out the use of the in-tape cassette to the C-0 out-of-tape plastic. The C-0 is empty, except for the leader. They cut the leader and splice their own high quality tape to the leader. They record the program and edit and test. They do not perform a 100% inspection, either visually, electrically or mechanically. They run a partial sample tension test and a leader splice test. They feel that they would lose the bid if they performed a 100% test of any sort - "Too Time Consuming".

  They realize that the eye cannot see within the cassette after it is wound, but have not given much thought to the use of radiographic testing. They feel that good components would reduce the need for 100% inspection. They also feel that maybe all (or most) of the problems are in the cassette (plastic) used - and not in the tape. They do not understand why the Maxell C-0 is the best and nobody can tell them. They have never seen the results of the Continental Testing Laboratory test program and do not have any idea why the Maxell C-90 tape is very good. It, however, is expensive at $.75 per cassette, including tape, but could be bought at $.16, if purchased as a standard C-0 cassette in large quantities.

- They assumed that nobody can really report what a good cassette plastic is. This led to the idea of suggesting a large quantity buy of a standardized cassette - pretested by DBPH and verified to a new set of specifications. If all of the cassette suppliers had such a cassette plastic of the C-0 type, it would solve many of their competitive problems and insure better quality. Visual inspections at the manufacturer's plant cannot predict what will happen to the material out in the field. They also claimed that the competitive price procurements out of DBPH do not permit them to pin down the manufacturing problems because of the high cost of test equipment. A tour of the cassette factories indicated this to be true.

- Incoming inspection is not available because of their assumption that good quality purchases of tape and cassettes basically insure that they will not have trouble. They do not run static charge tests but have rejected manufacturers of tape based upon previous experience. Trade-offs can be made in assuming that good quality (high price) is cheaper than incoming inspection; however, it is risky. It assumes that the selected manufacturer will maintain his quality level. The cassette supplier should also have the right to inspect at his tape manufacturer's plant. A sample check on frequency response and static charge seems to be a reasonable quality control compromise.

Several major reasons exist for abandoning the concept of using in-cassette tapes. It increases the probability of the cassette being unreliable. Even though it is the best cassette shell, there is no idea of whose tape is being used and what type of leader adhesive is being used. The use of the Pentagon machine for cassette loading is unreliable, due to its inability to assure consistent programming of the tape. All the companies went to the use of a C-0 tape where it is only loaded with the leader. The earlier Pentagon machine could handle a large quantity of cassettes, but caused too many rejects. APH uses AGFA-GEVAERT Tape, which they claim is a good quality tape; it is used by most good suppliers. This tape basically has not caused any static pickup problems. Static conditions are noticed when the tape comes out of the shipping carton and the first time it is run through a duplicator. Cartridge Control uses both BASF and 3M Tape.

DBPH does not know what it costs for maintenance and reader dissatisfaction because there is a lack of statistical data on the cassette malfunctions - or even the identification of what the malfunctions are. There is evidence, however, that the cassette is a major contributing factor. Additional manufacturer test equipment can be an expensive or inexpensive addition, depending on the field type of malfunction encountered. In order to hedge the risk, good field data is needed and should be analyzed to provide a good specification. A good cassette could also inversely reduce the amount of inspection labor required. In the engineering laboratories, certain tests are performed that represent their incoming inspection. These include tension tests using an M-100 Tension Monitor made by Information Terminals Inc., Mountain View, California. Cartridge Control does not utilize any form of incoming inspection on the cassette.

This test is performed at one hub speed at 20 rpm and, if it exceeds the Philips Standard Take-Up Hub Torque of 20 gm cm, it is rejected. Torque is a function of force x radius and in itself is not dependent upon speed; however, when the reels are loaded (especially with the thinner C-90), alternate speed tests may be an effective method of measurement. No tests are made at other speeds because they meet the Philips Standard. Since the Philips Standard was designed for normal hub speeds for a playback speed of 1-7/8 ips, it appears that it should be revised. There are no tests made at 40 rpm, or 400 rpm. These speeds may also be inadequate because they are also geared to 1-7/8 ips. The typical "rewind" or "fast forward" hub speed is 400 rpm.

The only other test made in the engineering laboratory is a leader test under temperature which is conducted in a small APH specially designed heat chamber. At APH, a new cassette just exhibited which is manufactured by Superscope Inc. was observed. This cassette contained a snap-arm tape retainer and did not have a window. It was made of clear, see-through plastic and does not meet the Philips Standard.

The cassette tape production line seems technically very acceptable. However, it is prone to quality problems because it assumes that everything most probably will work okay because it is okay - so why test it. The faith in good technology and good people is an unlikely method of achieving good statistical quality control. Even the most excellent machines and personnel have been known to fail - that is why production and product assurance testing have been developed as an art, in order to overcome this "faith".

It is very definitely recommended - in the case of cassette plastic - that DBPH develop a testing and specification program for the design of a C-0 Standard Cassette Plastic. Included should be tests for the following:

- Incoming Internal Visual Inspection
- Cassette Disassembly
- Cassette Torque
- Cassette Tape Guide Friction
- Hub Leader Retention
- Static Charge
- Splice Evaluation Under Temperature
- Pressure Pads

With proper quality control tests, the number of machine-to-cassette book interface malfunctions can be reduced.

4.3.2 Tape Problems

There is a considerable amount of apprehension on the part of the cassette duplicators in regard to the use of the C-90 cassette, as compared to the C-60 cassette. The thinner C-90 tape has less yield and breaking strength and is more difficult to handle in manufacturing. An extensive amount of quality control is needed at both the supplier's plant and at the duplicator's facility. Difficulties are encountered in winding and splicing, in addition to original splicing .150 inch dimension at the tape supplier's plant. They estimate that it would malfunction more frequently in the field as well; however, very little supportive data is available. The better cassette C-90's made by Maxell do not seem to verify that excessive maintenance problems exist in the field. A thorough comprehensive readers' analysis program is recommended before the decision is exercised on the C-90.

4.3.3 Cassette Book Specification Recommendations

In order to provide a more comprehensive test program to discover typical problems with cassettes, such as: 1) sticky tapes, 2) tape folds, 3) inconsistent spooling, 4) static discharge (audible tone), 5) low frequency noise, 6) pressure pad dislodging, 7) dirt collection, and 8) tape backlash or overshoot, the following types of test procedures to be included in future specifications are recommended.

Internal Inspection

It is recommended that DBPH investigate the different types of cassette plastics. If a clear plastic cassette can be utilized, a great number of problems can be reduced through a visual inspection. The use of such a cassette would also lessen the cost of test equipment to be employed on the production line, and would also permit a final quality control check to be made visually without guessing what is happening inside or through the use of expensive radiographic equipment. The internal inspection as a minimum should include the following examinations:

- Workmanship Quality
- Foreign Particle Contamination
- Anomalies in Construction Detail
- Position and Mounting of Pressure Pads and Shields
- Status of Magnetic Tape
  - Wrinkles
  - Spillage
  - Stickiness
  - Smoothness in Unwinding
  - Tightness
  - Loops

- Slip Sheets and Friction Liners
  - Frays and Wrinkles (other than intended crease)
  - Conductivity
- Hub-to-Tape Contact
- Leader Tape Used
- Tape/Leader Splice
  - Amount and Condition of Adhesive
  - Overlap and Gapping
  - Alignment
  - Protrusion or Excessive Material
- Seam Inspection
  - Screws or Thermal Weld
- Window Inspection
- Print and Braille Labels
- Cassette Corner Guides
- Reading Test - Procedure
  - Timing
  - Indexing Tones

It is also recommended that the following additional tests be included in any new specifications:

- Performance Under Varied Temperature Conditions
- Torque Analysis
  - Varied Speed
- Leader/Hub Retention Under Temperature
- Static Measurement
- Tape Guide Friction
- Hub Leader Retention Force
- Splice Evaluation
- Pressure Pads

Recommended Standard Tape Cassette Ideas

Do not use Philips Standard Cassette Specification (Twin-Hub, 4-track, mono/stereo) because it does not include the following types of changes which were recommended:

- Cassette Friction Torque - for full reel and both reels to include hub speed variations at normal play/fast forward, and reverse, including rack holdback torque
- High speed static discharge tests - using audible tone measurements
- Tape speed variations for 15/16 ips, as well as 1-7/8 ips
- Tolerances on measurements
- Use of friction liners with conductive material
- Tape guide friction liners at various speeds for normal play, rewind and fast forward
- Leader hub retention force under temperature requirements
- Splice tension test under temperature
  - Visual
  - Dimensional
  - Cut-angles and overlap
- Pressure Pad
  - Force test
  - Construction
  - Position
  - Penetration levels
  - Creepage
- Alternative of clear plastic vs. the window
- Use of simulated playback head in tests
- A better definition of recording characteristics curves to match equipment performance
- Freedom of types of tape guides
- Leader specifications, including the tape-to-leader splice and the adhesive under temperature conditions
- Qualification tests, which should be included for the following:
  - High Temperature Environment
  - Low Temperature Environment
  - High Humidity Environment
  - Drop Tests
  - Operational Life

4.3.4 Technical Discussion on Recording Programs

It is very important to have a high quality studio with adequate baffling and acoustical properties. Good studios can be outfitted for $50,000 - $75,000. However, very few manufacturers test their equipment in good anechoic chambers and the recording curve of the master is extremely better than the equipment playback system used. A higher percentage of equipment should be given good intelligibility scoring tests, using humans in the anechoic chamber to ascertain whether the unit provides the quality spelled out in specifications for sound pressure measurements. The ear is the only true indicator of equipment and recorded material quality. Readers in the field are not representative enough of quality because some complain about the recordings and others get used to bad audio quality.

Distortion is inserted in the 8-1/3 rpm record as a result of the preciseness of the record cutting instrument and the dimensions of the groove. At the

77

8-1/3 rpm speed, the distortion is not usually in the playback if the frequency and amplitude response of the equipment are properly designed, so that each of the components (including the pick-up cartridge, cassette heads, preamplifier, amplifier, speaker and case assembly) provide the fidelity of the response required. The required recorded sound presence is enhanced by the adjustment of the frequency response through the emphasis (or de-emphasis) of the signal characteristics through the use of the tone control. The loudness of the sound is adjusted by the volume control. At the recording studio, the type of sound is inserted into the system by the choice of narrator (male or female voice), the type of narration, and the acoustical properties of the sound room, the microphone and recording amplifier.

The background signal-to-noise (S/N) ratio must be minimized to achieve a high quality recording. In the recording studio, there is a need to compare the effective characteristics of the recorded sound on the disc when recorded at twice the playback speed to the entire recording studio's frequency characteristics. Equalization is provided, when necessary, to compensate for the changes in speed at the various diameters of the record. Test comparisons are usually made of the recorded magnetic tape versus the recorded sound on test records to insure an "(A-B)" comparison. If the materials specified for the master tape, the cassette tape and the flexible disc are of high quality in nature, then the problems in sound reproduction will occur in the cutting of the disc and the production stamping process. The recording heads of the duplicating recorders in the cassette duplication process - whether they be in the conversion recorders (1/4" 2-track to 1" 4-track), the loop pins or the slave recorders - must be carefully controlled to reproduce the best recorded original sound.

A further investigation of the commercial duplicating process is needed to determine whether special compensation or equalization is needed to provide higher average levels in order to insure better S/N ratio. Compatible recording characteristics have to be designed for both the flexible disc and the cassette.

The review of the recorded edition specifications indicates that several improvements for the future are needed. These include the following:

- Increasing the tolerance of the flexible disc beyond 9", since the manufacturer has proven that the 9" flexible disc is the most desirable size because of the material savings in production and improved quality.
- Changing the speed and pitch requirements to allow for replay with a more precise (.0005) playback stylus - if proven desirable. This should be accompanied by changes in the groove shape. Recommendations from the flexible disc manufacturers should be solicited.
- Increasing the number of minimum replays to be at least fifty (50).

- Using tests at frequency bands at the inner portion of the record, as well as the outer portion in order to detect changes in frequency response to correspond to the optimum recording characteristic.

- Changing (possibly) to a modified velocity curve above 500 cps to accommodate the 8-1/3 rpm requirement.

- Incorporating (possibly) compliance and uniformity of the recorded sound requirements to those provided by AFB.

The cassette specification should have a better definition than now exists in Paragraph 3.5.4 of DBPH Specification 75-103, which is purely a subjective basis for judging the acceptability of the sound.

4.4 Recommended Configurations

The study indicated that three distinct machines should be manufactured to accommodate reader preferences. This will include 1) a Combination Machine, 2) a Revised Cassette Book Machine and 3) a Revised Talking Book Machine. It is desirable to develop a large amount of "inverse purchasing power" by purchasing large quantities of high quality compatible subassemblies, which have been specified, researched, developed and tested by the Technical Staff at DBPH.

Many organizations would be seriously interested in being an assembler of the complete units. Several companies have expressed their interest during the last few months. Facilitation of their production plants would be very minimal and would not require any tooling, other than assembly and test equipment. It is recommended that the compatible subassemblies be used interchangeably among manufacturers. These compatible subassemblies should include:

1. a lighter tone arm with a plug-in cartridge
2. a plug-in amplifier
3. a speaker assembly
4. a motor (2 pole AC)
5. a turntable-cassette player subassembly
6. a case - varied in accordance with the different units

It is also recommended that the cassette book suppliers be given specifications for the following elements:

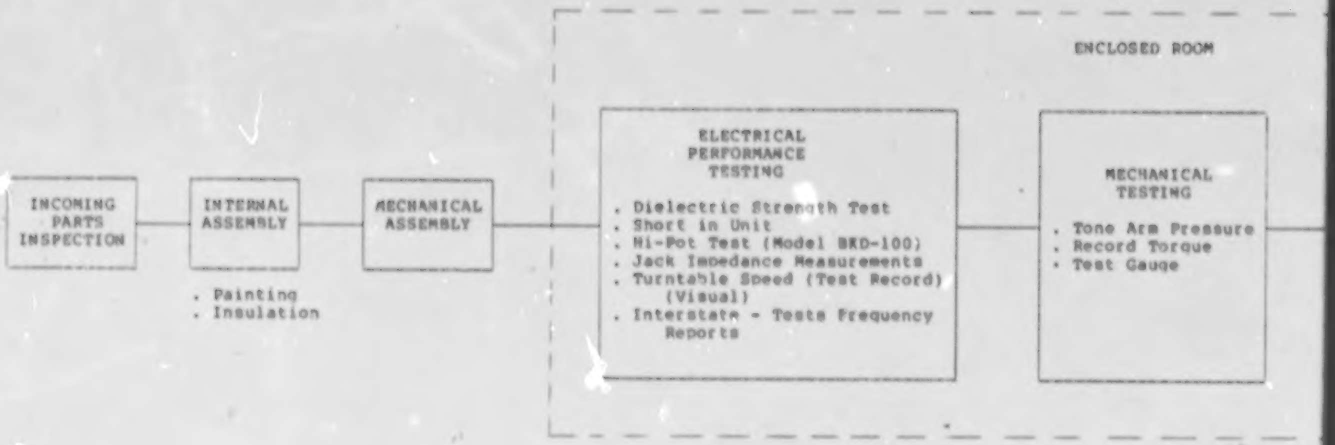
1. an improved Cassette-Plastic C-0 type standard
2. a choice of the specific C-90 type of tape (or tapes) to be used

3. a standard delivery package for cassette books, flexible disc books and magazines

It was frequently recommended during the study that an advisory group of both equipment manufacturers and recorded edition suppliers be convened to comment and provide agreement on the future technical standards to be employed. It is also recommended that flexible disc books be used (if proven capable of multiple replayings) for the most popular editions. Flexible disc magazines can be used for throwaway and can be circulated directly to the readers. The storage facilities at the libraries will have to be changed to accommodate the flexible disc book system. However, no significant problem exists. The fact that there will be in the future a significant number of CM's and TBM's will lessen the problems of the reader in having machines available.

Figures 4.1, 4.2 and 4.3 provide generalized flow charts for:

1. Equipment manufacturing
2. Cassette duplication and recording
3. Flexible disc production and recording


INCOMING PARTS INSPECTION
INTERNAL ASSEMBLY
. Painting
. Insulation
MECHANICAL ASSEMBLY
ENCLOSED ROOM
ELECTRICAL PERFORMANCE TESTING
. Dielectric Strength Test
. Short in Unit
. Hi-Pot Test (Model BKD-100)
. Jack Impedance Measurements
. Turntable Speed (Test Record) (Visual)
. Interstate - Tests Frequency Reports
MECHANICAL TESTING
. Tone Arm Pressure
. Record Torque
. Test Gauge

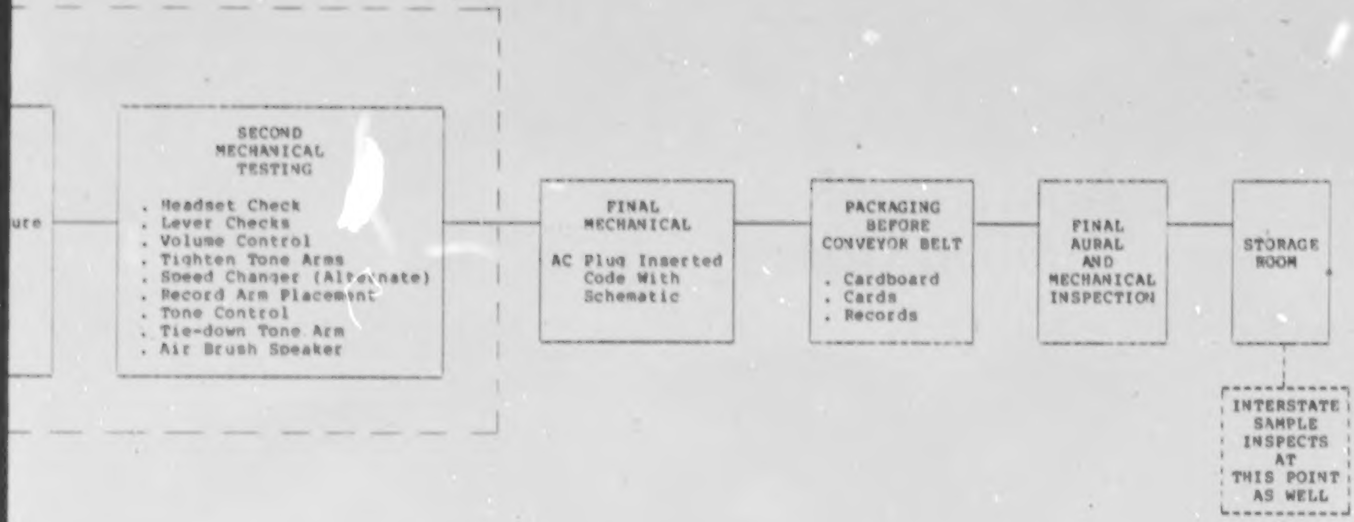

ure
SECOND MECHANICAL TESTING
. Headset Check
. Lever Checks
. Volume Control
. Tighten Tone Arms
. Speed Changer (Alternate)
. Record Arm Placement
. Tone Control
. Tie-down Tone Arm
. Air Brush Speaker
FINAL MECHANICAL
AC Plug Inserted Code With Schematic
PACKAGING BEFORE CONVEYOR BELT
. Cardboard
. Cards
. Records
FINAL AURAL AND MECHANICAL INSPECTION
STORAGE ROOM
INTERSTATE SAMPLE INSPECTS AT THIS POINT AS WELL

Figure 4.1

ASSEMBLY CYCLE AT
WATERS CONLEY
(TYPICAL OF INTERSTATE-LINE)

Figure 4.2

CASSETTE FLOW CHART
FOR MANUFACTURING (APH & CARTRIDGE CONTROL)

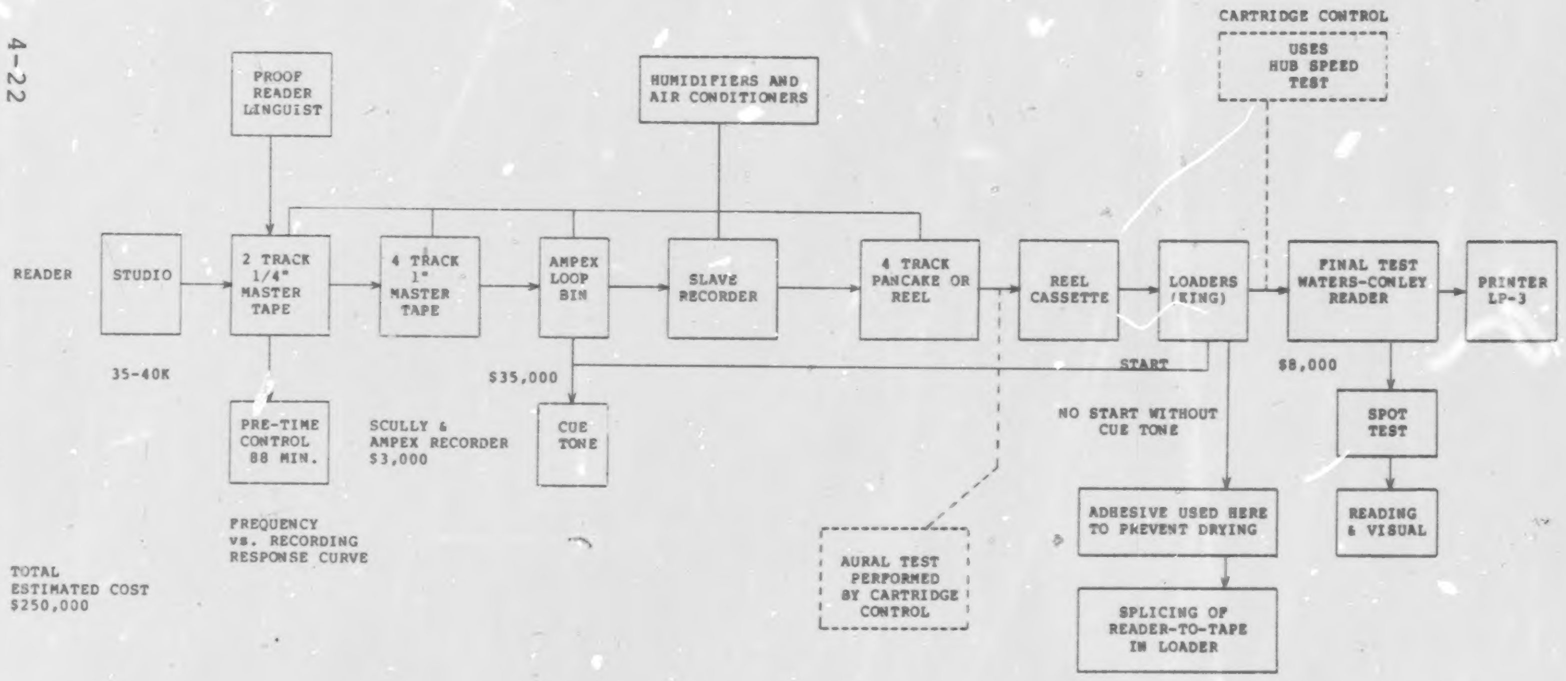
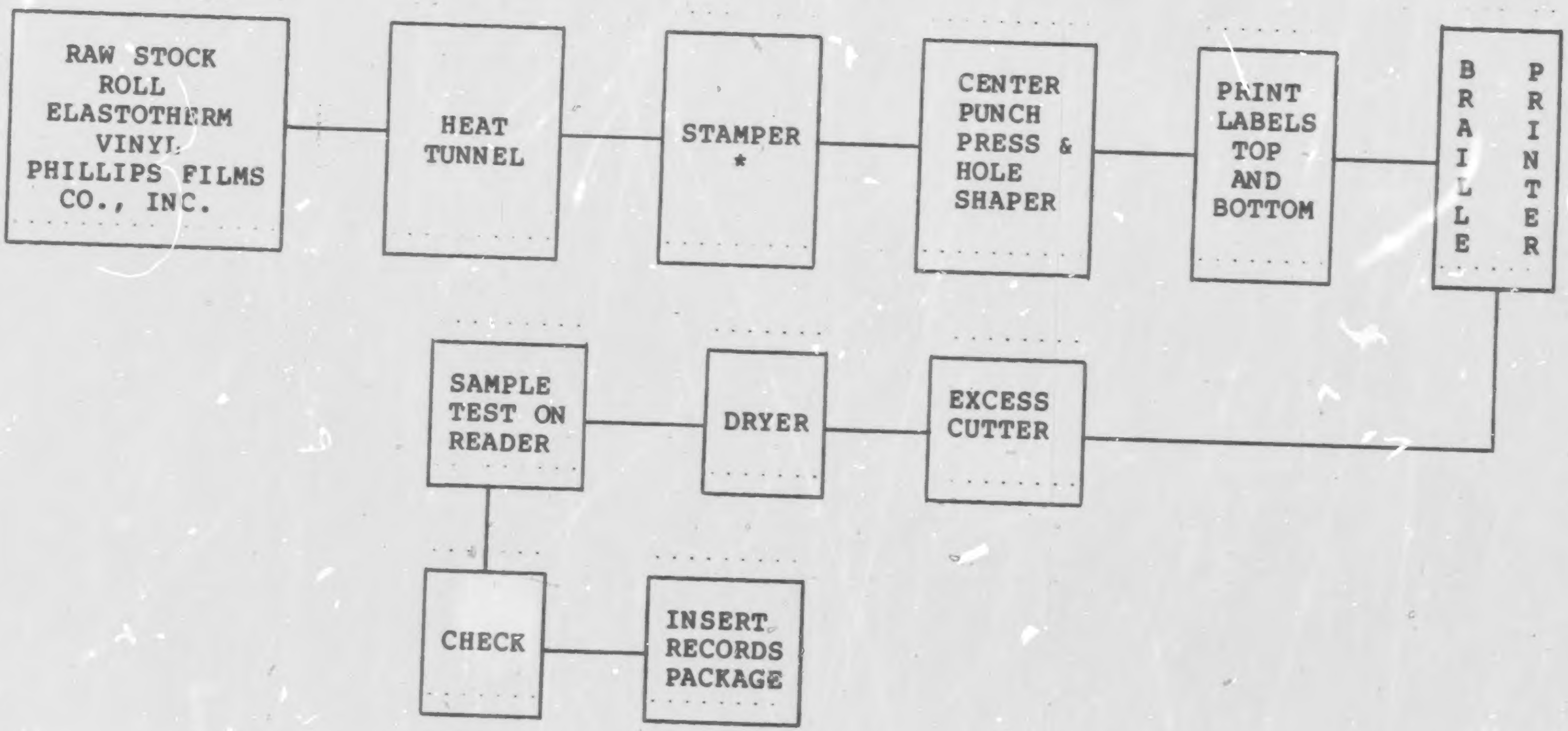

READER
STUDIO
35-40K
PROOF READER LINGUIST
2 TRACK 1/4" MASTER TAPE
PRE-TIME CONTROL 88 MIN.
FREQUENCY vs. RECORDING RESPONSE CURVE
4 TRACK 1" MASTER TAPE
SCULLY & AMPEX RECORDER $3,000
AMPEX LOOP BIN
$35,000
CUE TONE
HUMIDIFIERS AND AIR CONDITIONERS
SLAVE RECORDER
4 TRACK PANCAKE OR REEL
AURAL TEST PERFORMED BY CARTRIDGE CONTROL
REEL CASSETTE
START
NO START WITHOUT CUE TONE
LOADERS (KING)
ADHESIVE USED HERE TO PREVENT DRYING
SPLICING OF READER-TO-TAPE IN LOADER
CARTRIDGE CONTROL
USES HUB SPEED TEST
FINAL TEST WATERS-CONLEY READER
$8,000
SPOT TEST
READING & VISUAL
PRINTER LP-3
TOTAL ESTIMATED COST $250,000

Figure 4.3

FLOW CHART OF
FLEXIBLE DISC
MANUFACTURING PROCESS


RAW STOCK ROLL ELASTOTHERM VINYL PHILLIPS FILMS CO., INC.
HEAT TUNNEL
STAMPER *
CENTER PUNCH PRESS & HOLE SHAPER
PRINT LABELS TOP AND BOTTOM
BRAILLE PRINTER
EXCESS CUTTER
DRYER
SAMPLE TEST ON READER
CHECK
INSERT RECORDS PACKAGE

* EVA-TONE MAKES A MULTIPLE NUMBER OF STAMPERS FROM THE MASTER THROUGH AN ELECTRO-FORM PROCESS AND REPLACES THEM ON THE PRODUCTION LINE ON THE AVERAGE OF 5,000 - 10,000 STAMPINGS.

SECTION 5

FINANCIAL ANALYSIS

5.1 General Approach

The financial methodology employed started with the FY 1976 appropriation request because the funds were already committed by line item. Since no predetermined decisions had been made on the exact quantities of equipment or the amount of recorded materials to be procured, a choice of the amount of each of these reader products to be purchased within the financial constraints of the FY 1976 budgeted line item had to be made. It was very important at the start of the study to establish certain definitive statistical bench marks which were based upon figures provided by DBPH planning personnel. The following significant numbers were used:

END OF FY 1976

Number of Readers	=	575,000
Estimated Cost/Reader	=	$24.71
Cost for Audio Services Program	=	$14,209,000

The assumption of 575,000 eligible readers at the end of FY 1976 was based on DBPHprovided figures which assume that four machines will service five readers. Currently, one machine services ten readers in hospitals and institutions. It was also assumed that the FY 1976 budget of $15.8 million for the DBPH program will be approved; therefore, the budget can be subdivided into the following elements:

Direct Costs for Audio Services Program	=	$11.2 million
Direct Costs for the Balance of Activity	=	$ 1.3 million
Total Direct Costs	=	$12.5 million
Indirect Costs	=	$ 3.3 million
Total DBPH FY 1976 Budget	=	$15.8 million

The current percentage of indirect costs allocated to the recorded books and magazine program is 89.6. Therefore, the amount of indirect costs prorated to the Audio Services in FY 1976 is 89.6% of $3.3 million - or $3.0 million. Combining the direct cost figure of $11.2 million and the $3.0 million gives a starting total of $14.2 million. The following assumptions were made regarding the FY 1976 estimates:

Equipment Purchases and Titles Recorded	Quantity	Specified Unit Cost
CBM's Purchased	61,000	$ 63
TBM's Purchased	36,000	$ 40
Book Titles Recorded	1,000	$1,060
Volunteer Recorded Book Titles	50	$ 8

Recorded Editions	Number of Titles
Magazines Recorded	26
Flexible Disc Books for Experimental Titles	50
Rigid Disc Books	500
C-90 Cassette Books	450

Three financial models were prepared which are shown as Figure 5.1, Talking Book Model; Figure 5.2, Flexible Disc Magazine Model; and Figure 5.3, Equipment Conversion Plan. These financial models were used in discussions with the manufacturers, the reproduction companies and the DBPH staff. The numbers presented above are used as the bench mark figures for the financial analysis. The models assumed an increase in acquisition of titles at a rate of 20% per annum and the mixture of talking books, cassette books and magazine copies are varied according to reader preferences in the financial models. It is also assumed that DBPH will discontinue the production of rigid discs by early FY 1977 and the recorded programs will be on C-90 cassettes and flexible discs at 8-1/3 rpm. All cassettes will be recorded at 15/16 ips, using 4-track recordings.

5.2 Financial Plans

On the basis of the assumptions made, twelve financial plans were developed to provide a variety of alternatives available to DBPH. Each of the plans is based upon very distinctive assumptions that provide a different preference for DBPH in their presentations to the LC Administration and to the Congressional Appropriations Committee.

Plan 1

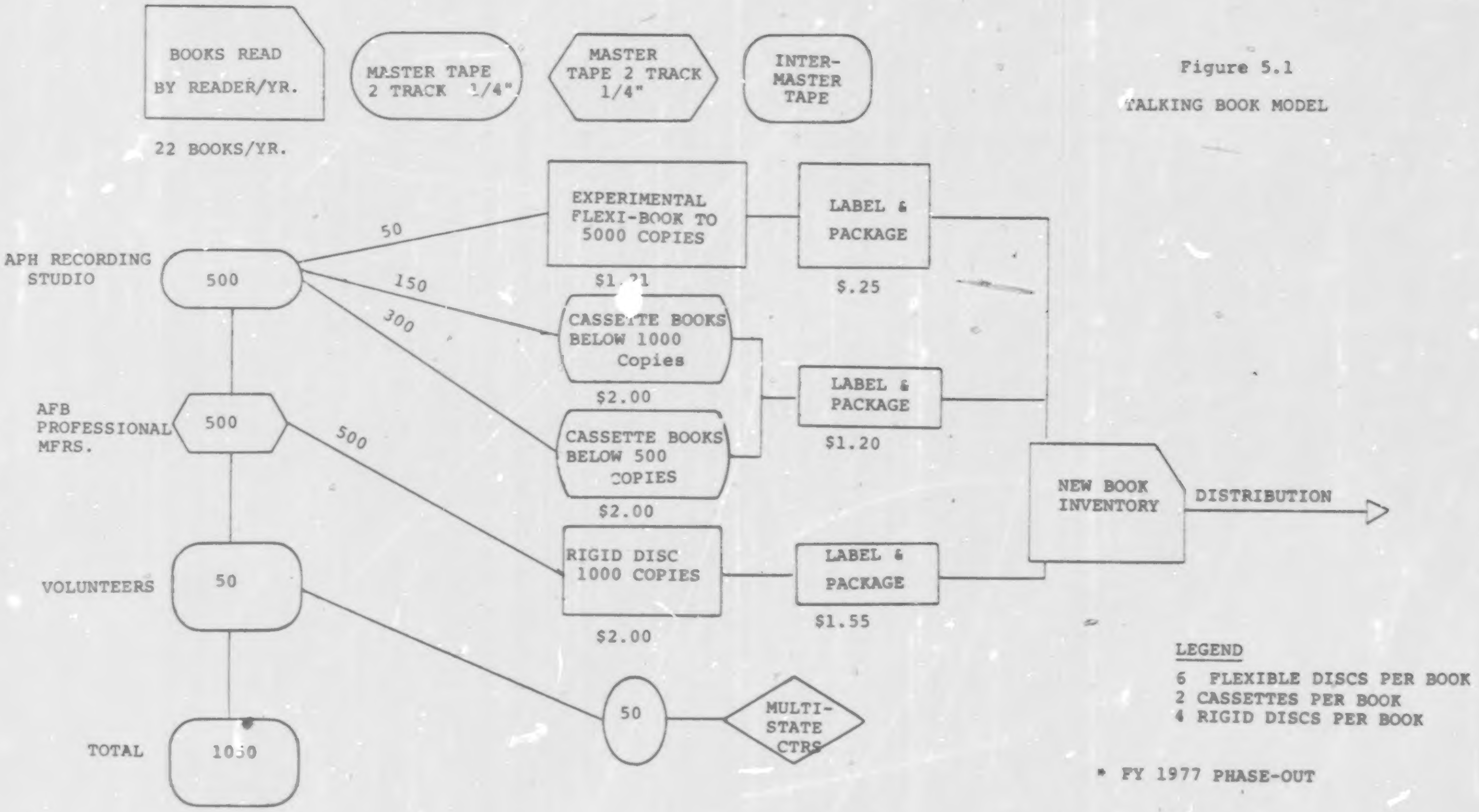
This plan increases the growth of reader population at a rate of 20% per year towards a goal of 2.25 million (30% of target population) and assumes a 10% discount rate on the U. S. dollar due to inflation.

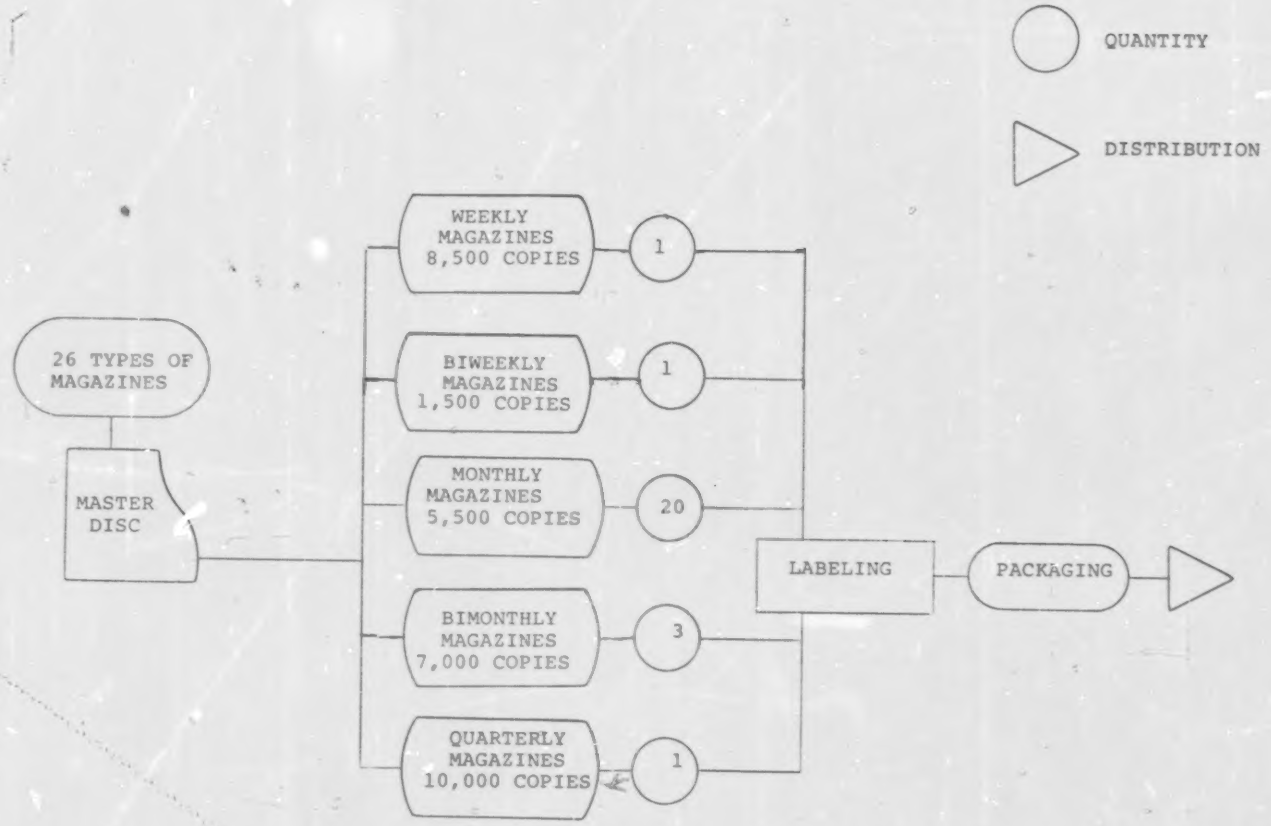
Plan 2

This plan increases the reader population at a rate of 20% per year towards a goal of 2.25 million readers by implementing the most cost-effective program (constrained to a maximum increase in the cost per reader per year of 3%). Least cost is obtained by using compatible subassemblies and large purchasing

Figure 5.1

TALKING BOOK MODEL


BOOKS READ BY READER/YR.
22 BOOKS/YR.
MASTER TAPE 2 TRACK 1/4"
MASTER TAPE 2 TRACK 1/4"
INTER-MASTER TAPE
APH RECORDING STUDIO
500
AFB PROFESSIONAL MFRS.
500
VOLUNTEERS
50
TOTAL
1050
50
150
300
500
EXPERIMENTAL FLEXI-BOOK TO 5000 COPIES
$1.21
CASSETTE BOOKS BELOW 1000 Copies
$2.00
CASSETTE BOOKS BELOW 500 COPIES
$2.00
RIGID DISC 1000 COPIES
$2.00
50
MULTI-STATE CTRS
LABEL & PACKAGE
$.25
LABEL & PACKAGE
$1.20
LABEL & PACKAGE
$1.55
NEW BOOK INVENTORY
DISTRIBUTION
LEGEND
6 FLEXIBLE DISCS PER BOOK
2 CASSETTES PER BOOK
4 RIGID DISCS PER BOOK
* FY 1977 PHASE-OUT


QUANTITY
DISTRIBUTION
26 TYPES OF MAGAZINES
MASTER DISC
WEEKLY MAGAZINES 8,500 COPIES
BIWEEKLY MAGAZINES 1,500 COPIES
MONTHLY MAGAZINES 5,500 COPIES
BIMONTHLY MAGAZINES 7,000 COPIES
QUARTERLY MAGAZINES 10,000 COPIES
1
1
20
3
1
LABELING
PACKAGING

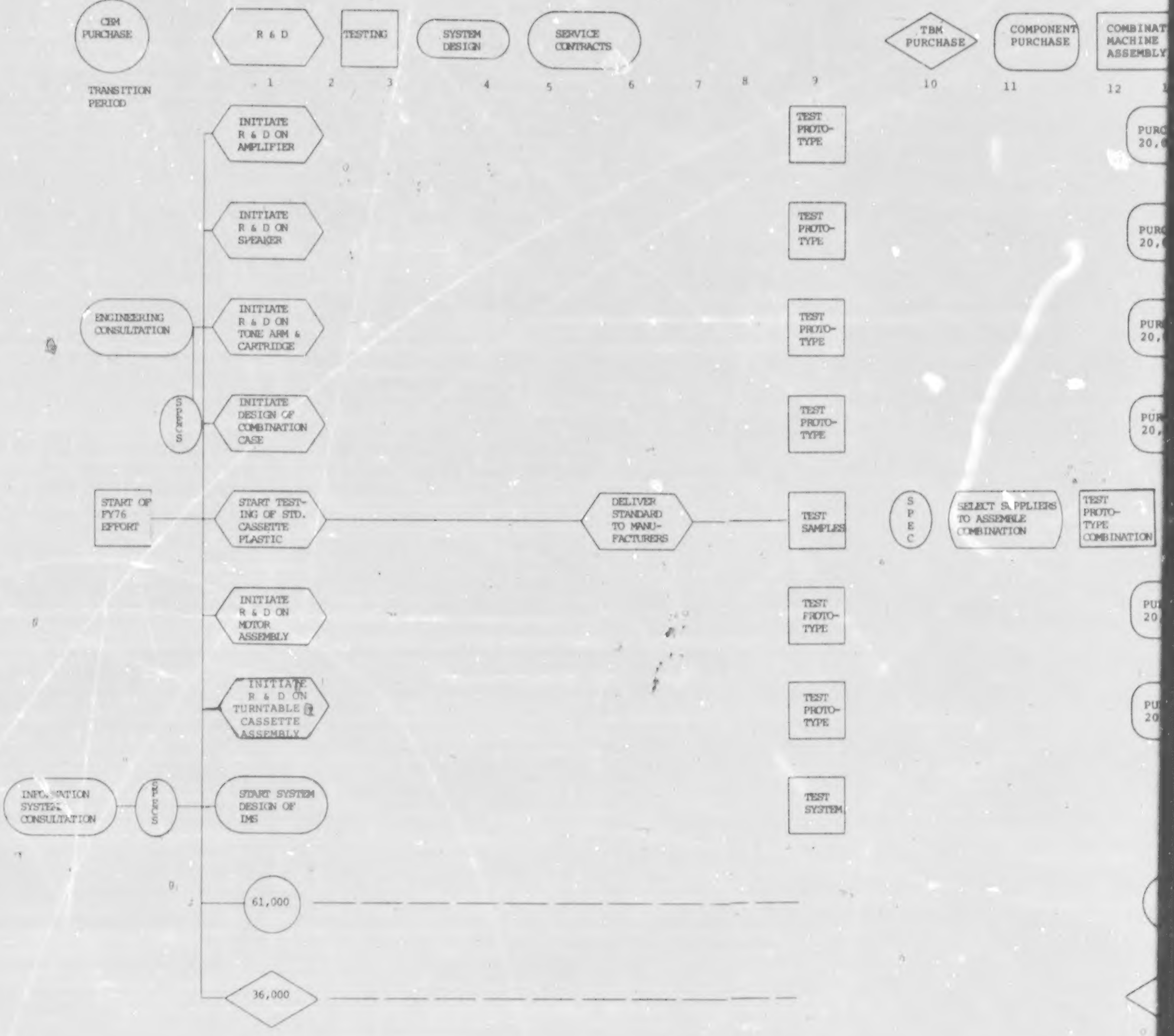
LEGEND

Need to Consider Cost/Volume Ratio

3 Flexible Discs - 1 Average Magazine

Figure 5.2

FLEXIBLE DISC MAGAZINE MODEL


CBM PURCHASE
R & D
TESTING
SYSTEM DESIGN
SERVICE CONTRACTS
TBM PURCHASE
COMPONENT PURCHASE
COMBINAT MACHINE ASSEMBLY
TRANSITION PERIOD
1
2
3
4
5
6
7
8
9
10
11
12
ENGINEERING CONSULTATION
START OF FY76 EFFORT
INFORMATION SYSTEM CONSULTATION
INITIATE R & D ON AMPLIFIER
INITIATE R & D ON SPEAKER
INITIATE R & D ON TONE ARM & CARTRIDGE
INITIATE DESIGN OF COMBINATION CASE
START TESTING OF STD. CASSETTE PLASTIC
INITIATE R & D ON MOTOR ASSEMBLY
INITIATE R & D ON TURNTABLE & CASSETTE ASSEMBLY
START SYSTEM DESIGN OF IMS
61,000
36,000
DELIVER STANDARD TO MANUFACTURERS
TEST PROTOTYPE
TEST PROTOTYPE
TEST PROTOTYPE
TEST PROTOTYPE
TEST SAMPLES
TEST PROTOTYPE
TEST PROTOTYPE
TEST SYSTEM
S P E C
SELECT SUPPLIERS TO ASSEMBLE COMBINATION
TEST PROTOTYPE COMBINATION
PURC 20,0
PURC 20,
PUR 20,
PUR 20,
PU 20,
PU 20

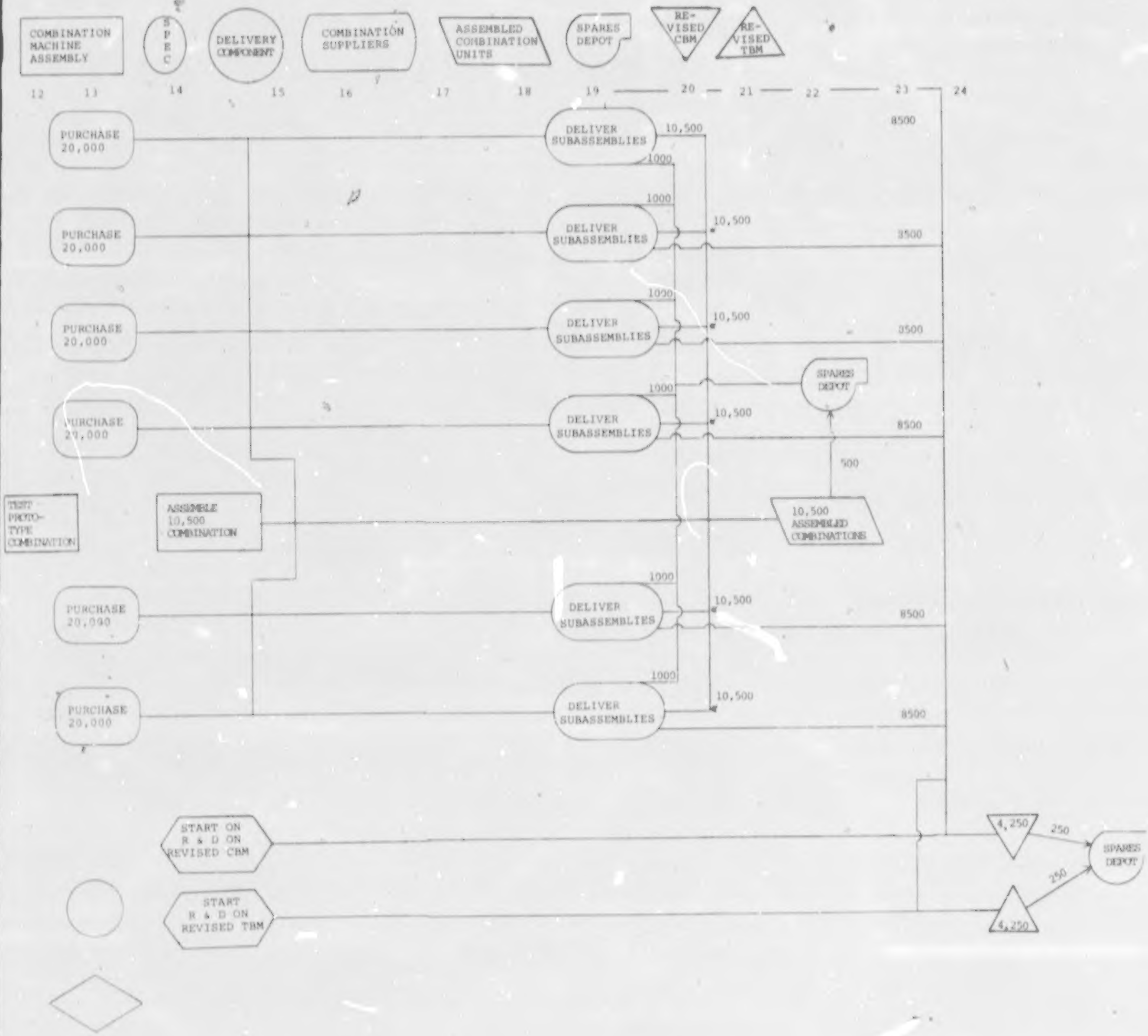

COMBINATION MACHINE ASSEMBLY
SPEC
DELIVERY COMPONENT
COMBINATION SUPPLIERS
ASSEMBLED COMBINATION UNITS
SPARES DEPOT
RE-VISED CBM
RE-VISED TBM
12
13
14
15
16
17
18
19
20
21
22
23
24
PURCHASE 20,000
DELIVER SUBASSEMBLIES
10,500
1000
8500
PURCHASE 20,000
DELIVER SUBASSEMBLIES
1000
10,500
8500
PURCHASE 20,000
DELIVER SUBASSEMBLIES
1000
10,500
8500
SPARES DEPOT
PURCHASE 20,000
DELIVER SUBASSEMBLIES
1000
10,500
8500
500
TEST PROTO-TYPE COMBINATION
ASSEMBLE 10,500 COMBINATION
10,500 ASSEMBLED COMBINATIONS
PURCHASE 20,000
DELIVER SUBASSEMBLIES
1000
10,500
8500
PURCHASE 20,000
DELIVER SUBASSEMBLIES
1000
10,500
8500
START ON R & D ON REVISED CBM
4,250
250
SPARES DEPOT
START R & D ON REVISED TBM
250
4,250

FIGURE 5.3

EQUIPMENT CONVERSION PLAN

power. This plan includes Revised Talking Book Machines (RTBM's), Revised Cassette Book Machines (RCBM's) and Combination Machines (CM's). A significant amount of flexible disc production was utilized because of the quantities of the TBM's and CM's. It assumes that the readers will be satisfied with flexible disc books and magazines and that there is a decline in the desire for cassette book materials.

Plan 3

This plan utilizes the budgets previously submitted for the next five years by DBPH and applies a 10% discount rate on the U. S. dollar. It also assumes a ratio of three CBM's to two TBM's for this analysis. The DBPH budget as submitted did not reflect an increase in reader population at a rate of 20% per year.

Plan 4

This plan evaluates the current five year budget plan by DBPH and assumes implementation of the most cost-effective program (constrained to a maximum increase in the cost per reader per year of 3%) over the next five year period. The reader population rate increase in this plan is not presented at a rate of 20% per year.

Plan 5

This plan increases the reader population at a rate of 20% per year and varies the purchasing mix of the present TBM's and CBM's by assuming readers prefer recorded magazines to recorded books using machines currently being purchased at a rising 10% inflationary discount rate in costs for equipment and material.

Plan 6

This plan varies the purchasing mix of current TBM's and CBM's and assumes that the readers prefer the recorded books to magazines and uses a 10% inflationary discount rate and an increase in reader population at a rate of 20% per year.

Plan 7

This plan varies the purchasing mix of the current TBM's and CBM's and assumes that the readers prefer both magazines and cassette books equally. It assumes that the average number of current readers of books is twice the number of the readers of magazines. This plan utilizes a 10% inflationary discount rate and increases the reader population at a rate of 20% per year.

Plan 8

This plan varies the purchasing mix of the RTBM's and RCBM's and assumes that the readers prefer both magazines and cassette books equally. It also assumes that DBPH will use the most cost-effective program (constrained to a maximum increase in the cost per reader per year of 3%) over the next five years and that the reader population will increase at a rate of 20% per year. This plan assumes that DBPH will provide two magazines for every cassette book.

Plan 9

This plan varies the purchasing mix of both the RTBM's and RCBM's using the most cost-effective program (constrained to a maximum increase in the cost per reader per year of 3%) over the next five years and assumes that the readers prefer recorded magazines to recorded books. The amount of readers was increased at a rate of 20% per year. In assumptions made for this plan, three RTBM's to one RCBM were purchased, and CM's were not included. This plan assumes that the R&D program did not lead to a desirable CM.

Plan 10

This plan varies the mix of RCBM's and RTBM's and assumes that readers prefer both the magazines and the cassette books equally. It assumes that DBPH goes ahead with the CM and that they use the most cost-effective program (constrained to a maximum increase in the cost per reader per year of 3%) over the next five years. It assumes that the reader population increases at a rate of 20% per year.

Plan 11

This plan increases the reader population at a rate of 20% per year towards a goal of 2.25 million readers by implementing the most cost-effective program (constrained to a maximum increase in the cost per reader per year of 3%) so that the future equipment purchases after FY 1976 include only the CM. The reader is offered only one type of machine during the year FY 1977. Until that time, DBPH continues purchasing the current CBM's and TBM's. This plan assumes a hurried R&D program and a rapid entry into using the CM. Also assumed is a preference for books recorded in the flexible disc form.

Plan 12

In this plan, DBPH continues to purchase the older CBM's and TBM's and assumes that the CM's are introduced in FY 1978, observing the same ground rules of the plan above.

5.2.1 Summary of Planning Concept

In each of the plans where the increases in cost per reader were constrained by using the cost-effective program (constrained to a maximum increase in the cost per reader per year of 3%), the prices of the new equipment and re-cprded material were inflated at a 10% inflationary rate. Figure 5.4 provides a summary of the five year totals of the twelve cost plans. It should be recognized

Conversion Plans	New Titles	Program Cost ($ 000)	Number of Readers	Average Cost Per Reader (dollars)	NUMBER OF EQUIPMENT PURCHASES					
					CBM	TBM	RCBM	RTBM	CM	To Eq
1	7,442	104,259	1,192,320	87.44	523,000	286,000				8
2	7,442	88,512	1,192,320	74.23	107,000	95,000	118,000	351,000	295,000	8
3	5,500	75,741	739,288	102.45	359,000	235,000				5
4	5,500	75,741	961,792	78.75	105,000	79,000	121,000	118,000	233,000	6
5	7,442	104,259	1,192,320	87.44	181,000	824,000				1,0
6	7,442	104,259	1,192,320	87.44	624,000	126,000				7
7	7,442	104,259	1,192,320	87.44	441,000	416,000				8
8	7,442	88,512	1,192,320	74.23	111,000	86,000	201,000	202,000	222,000	8
9	7,442	88,512	1,192,320	74.23	81,000	145,000	211,000	616,000		1,0
10	7,442	88,512	1,192,320	74.23	111,000	86,000	308,000	309,000	80,000	8
11	7,442	88,512	1,192,320	74.23	61,000	36,000			564,000	6
12	7,442	88,512	1,192,320	74.23	125,000	99,000			470,000	6

Total New Equipment	Average Number of New Equipment Per Reader	Number of Flexible Disc Magazines	Number of Flexible Disc Books	Number of Rigid Disc Books	Number of Cassette Books	Average Number of Flexible Disc Books Per Reader	Average Number of Cassette & Rigid Disc Books Per Reader
809,000	0.679	12,488,000	1,000,000	550,000	5,291,000	11.31	4.90
866,000	0.726	12,810,000	6,679,000	550,000	2,400,000	16.35	2.47
594,000	0.803	12,488,000	1,000,000	550,000	3,374,000	18.24	5.31
656,000	0.682	11,151,000	1,000,000	550,000	4,556,000	12.63	5.31
1,005,000	0.843	17,279,000	1,000,000	550,000	4,510,000	15.33	4.24
750,000	0.629	12,050,000	1,000,000	550,000	5,223,000	10.11	4.84
857,000	0.719	17,715,000	1,000,000	550,000	4,450,000	15.70	4.19
822,000	0.689	17,273,000	1,000,000	550,000	4,375,000	15.33	4.13
1,053,000	0.883	17,110,000	1,500,000	550,000	4,168,000	15.61	3.96
894,000	0.750	17,274,000	1,000,000	550,000	4,375,000	15.33	4.13
661,000	0.554	14,042,000	6,744,000	550,000	2,200,000	17.43	2.31
694,000	0.582	14,042,000	6,744,000	550,000	2,200,000	17.43	2.31

Figure 5.4

SUMMARY OF COST PLANS

FOR FIVE YEAR PROGRAM

that a myriad of combinations are possible; however, for the purposes of this study, it is believed that these plans are indicative of most of the programs that could be undertaken in accordance with the recommendations made in the remainder of this study.

5.3 Supporting Data for Cost Plans (Refer Back to Financial Models)

5.3.1 Sound Reproduction Estimates

In deriving the five year cost plans shown in Figure 5.4, several assumptions were made which were confirmed during site visits and the discussions with DBPH personnel. These are identified in the following statements:

A. Approximately 3.8% of the total 28,000 new book titles will be selected for master tape production in FY 1976 (1,050 new book titles).

B. Rigid discs will be reproduced for 500 titles in one year. The final phase-out of rigid discs will take place at the start of FY 1977.

C. Two 4-track C-90 cassettes are needed to produce one average book.

D. Six flexible discs (12 sides) are needed to produce one average book.

E. Twenty-six magazines will be produced (1 weekly, 1 bi-weekly, 20 monthly, 3 bi-monthly, and 1 quarterly issues).

F. Twenty-two books are read (on the average) by each reader in one year.

G. An average of one title will be recorded for every 575 readers.

H. All new books produced (flexible discs and cassettes) will be put into circulation (regional libraries). DBPH will determine the number of copies of each title that will be distributed to each of the libraries.

I. The growth rate of new titles was set at 20% per annum.

J. The portion of the sound recordings budget used for program materials outside the scope of this investigation is 10%.

Three manufacturers have the available facilities for the production of the 1,050 new book titles selected. The number of titles per manufacturer, as well as the number of copies and format per title, are outlined as follows:

A. APH can record 500 new book titles on 2-track, 1/4" master tapes. Of these 500 master tapes:

- Fifty (50) master tapes (most popular new book titles) will be utilized in the production of experimental books on flexible discs @ 5000 copies each ($1.46 per book). Eva-Tone or APH can mass produce these titles.
- One hundred fifty (150) master tapes (popular new book titles) will be utilized in the production of books on cassettes @ $\leq$1000 copies each ($3.20 per copy). APH, Cartridge Control, or other commercial sources can mass produce these titles.
- Three hundred (300) master tapes (new book titles) will be utilized in the production of books on cassettes @ $\leq$ 500 copies each ($3.20 per copy). APH or other cassette duplicator manufacturers can mass produce these titles.

B. AFB can record 500 new titles on 2-track, 1/4" master tapes. These will be utilized in production of rigid discs at 1,000 copies each ($3.55 per copy).

C. Volunteers will record 50 new book titles on intermaster tapes. All 50 master tapes will be put into storage for utilization - upon demand - in the production of books on cassettes @ $\leq$ 500 copies each.

In summary, of the 1,050 master tapes produced:

A. Fifty (50) master tapes (most popular new book titles) will be utilized in the production of books on flexible discs @ $\leq$5000 copies each ($302,500).

B. One hundred fifty (150) master tapes (popular new book titles) will be utilized in the production of books on cassettes @ 1000 copies each ($300,000).

C. Three hundred (300) master tapes (new book titles) will be utilized in the production of books on cassettes @ 430 copies each ($258,000).

D. Five hundred (500) master tapes (new book titles) will be utilized in the production of books on rigid discs @ 1000 copies each ($1,000,000).

E. Recording costs are considered at $120 for each 88-minute tape; intermaster costs are considered at $12.50 for 3 copies of each 88-minute tape. The total recording and intermaster cost for each title is therefore $1,060 ($1,060,000 for 1000 titles).

F. Fifty (50) master tapes (new book titles) will be prepared by volunteers and sent to multi-state centers for duplication as requests are received ($400).

All copies (≤ 1,000,000) of the 1,000 new book titles that are mass produced are then labelled and packaged ($1,195,500) and put into inventory for circulation.

One or two manufacturers (APH and/or Eva-Tone) will be responsible for the production of 26 types of magazines (weekly, bi-weekly, monthly, bi-monthly, and quarterly issues on flexible discs). FY 1976 magazine production will include:

A.	1 weekly magazine averaging 8,500 copies	$174,000
B.	1 bi-weekly magazine averaging 1,500 copies	26,000
C.	20 monthly magazines averaging 5,500 copies	496,000
D.	3 bi-monthly magazines averaging 7,000 copies	46,000
E.	1 quarterly magazine averaging 10,000 copies	15,000
	Total Cost	$757,000

All copies of the 26 magazines will be packaged and mailed directly to the reader.

5.3.2 Equipment Cost Assumptions

In the financial plans, specific estimates were used for the equipment being recommended. The prices were validated as a result of discussions with the various manufacturers and with personnel in DBPH who have handled previous procurements. The equipment prices can be delineated in the following manner:

Current CBM's (1976) = * $63.00
Current TBM's (1976) = * $40.00
RCBM's = ** $58.00
RTBM's = ** $35.00
CM's = ** $75.00

The prices given for the new machines are based upon using the "compatible subassembly" concept in all three new machines. These prices are based upon purchasing large quantities (20,000 and over) on a continuous basis of procurement and utilizing low-overhead assembly manufacturers to assemble, test, provide product quality assurance, package and deliver the equipment to the network system. Adequate spares provisioning for both equipment and compatible subassemblies are included in the large quantity subassembly purchases.

---

* Current projected DBPH procurement price.
** Manufacturers' verification of estimate obtained.

The optimum conversion program plan recommends the following actions which have been reflected into the cost figures used in the budget.

- During the transition period prior to the start of FY 1976, the issuance of an engineering consultation contract is recommended to help formulate the needed new technical specifications and to work with DBPH staff and an advisory group of manufacturers in approving the new specifications. These specifications should be delivered by the start of the first month of FY 1976. The cost for this effort has been estimated to be $10,000.
- During the first through the eighth month of FY 1976, it is recommended that a comprehensive research and development program be conducted on the compatible subassemblies (amplifier, tone arm, speaker, motor, turntable cassette player subassembly and the cases) to be used. It is estimated that the total R&D program should cost $75,000.
- During the first five months of the program, the testing of a standard C-0 type of cassette should take place. An estimated cost for the test of nine different samples is $10,000. This program should result in a completely defined C-0 standard, as well as a defined C-90 tape which will provide the reliable operation needed in the field.
- During the ninth to the twelfth month, the compatible subassemblies should be tested by DBPH at an estimated testing cost of $14,000.
- The cost for developing the specifications for the CM, RTBM, and RCBM is estimated to be $5,000.
- The cost for developing, assembling and testing the new prototype CM is estimated to be $26,000.
- The cost for developing, assembling and testing the prototype RTBM is estimated to be $13,000.
- The cost for developing, assembling and testing the prototype RCBM is estimated to be $13,000.

By the end of the first year of the program (twelfth month), all prototype and sample testing should be completed.

- During the thirteenth month, 20,000 pieces of each of the components are to be purchased:

- 20,000 amplifiers @ $6.00 each
- 20,000 speakers @ $2.00 each
- 20,000 tone arms and cartridges @ $6.00 each
- 20,000 cases @ $8.00 each
- 20,000 motor assemblies @ $6.50 each
- 20,000 combination assemblies @ $16.00 each

By the nineteenth month, all the components should be delivered to the proper manufacturer/assembler. The 20,000 pieces of each component delivered should be routed in the following manner:

A. 10,500 pieces of each component, in addition to the 10,500 combination cases, should be delivered to the supplier assembling the combination units by the start of the twentieth month.

B. 1,000 pieces of each of the components should be delivered to a multi-state spares depot by the end of the twentieth month.

C. 8,500 pieces of each of the components should be delivered to the supplier assembling the RCBM and the RTBM.

In summary, 10,500 combination units will be assembled by the twenty-second month of the program; 10,000 assembled combination units will be circulated and 500 assembled combination units will be delivered to a multi-state spares depot; 4,250 RTBM's and 4,250 RCBM's will be assembled by the end of the twenty-fourth month of the program; 4,000 assembled units of each machine will be delivered to a multi-state spares depot. The multi-state spares depot will then contain 1,000 pieces of each compatible subassembly, 500 assembled CM's, 250 assembled RCBM's, and 250 assembled RTBM's.

At the program's start (first month), current CBM's and TBM's will be purchased (cost = $5,266,667) and delivered to the DBPH network throughout the first year. At the start of the thirteenth month, a "phase-out" quantity of current CBM's and TBM's will have to be purchased (cost = $2,984,940) and delivered to the DBPH network (the quantity will vary by budget plan). During the fifteenth month, research and development (cost = $30,000) will be initiated on the RCBM's and the RTBM's. By the start of the third year of the program (twenty-fifth month), only RCBM's and RTBM's will be purchased (cost = $3,315,180).

During the transition period before the official start of the program, information systems consultation (estimated cost = $5,000) will result in the specifications for an information management system on equipment malfunction, repair and reader reactions. The system design (estimated cost = $7,500) will begin during the first month and continue through to the end of the eighth month. During the ninth to twelfth months the system will be tested (estimated cost = $4,000) and implementation of the system should occur during the thirteenth month (estimated cost = $3,500).

5.3.3 Detailed Financial Presentations

Several charts have been prepared for the financial presentations, illustrating the assumptions which were used.

- Figure 5.5 - Each individual plan by readers and by program budgeted cost by year - Audio Services Program only.
- Figure 5.6.1 through Figure 5.6.12 - Individual plans subdivided by year by line item. Line items 31E and 31F show the distribution of equipment and recorded material.

5.3.4 Budget Assumptions

Direct Costs

In Section 5.1 it was illustrated that the Audio Services Program portion of the direct cost is 89.6% of the FY 1976 budget. In order to develop correlations to the total budget submission made by DBPH, the 10.4% portion not considered (element 31D - Books in Raised Character) must be added back to the budget; and throughout the five year period, the numbers supplied by DBPH for this line item must be used. It is now possible to develop an indirect cost rate for FY 1976 as follows:

(a)	Total Direct Costs	$12,505,750
(b)	Total Indirect Costs	3,341,250
(c)	Total DBPH FY 1976 Budget	$15,847,000

$$\frac{(b)}{(c)} = 26.7177\%$$

In the indirect cost assumptions, it was assumed that this rate will remain constant over the five years for each plan.

Indirect Costs

In Figures 5.6.1 through 5.6.12, Audio Services Program Direct Costs for twelve possible five year plans were developed. By applying the 26.7177% rate against the total direct cost (Audio Services Program Direct Cost 89.6% plus Other Direct Costs 10.4%), the total indirect cost by year is obtained, which can then be allocated proportionately using judgment values based on the following assumptions:

Line Item 11 - (Personnel)

No adjustments were made to this cateogry. Salary figures supplied by DBPH were considered sufficient for five year planning purposes. The increase in workload created by the increase in readers will be appropriately covered by the use of new automated systems and methods.

		1976	1977	1978	1979	1980
PLAN 1	Readers	575,000*	690,000	828,000	993,600	1,192,320
	Cost/Reader	24.71+*	27.18	29.90	32.89	36.18
	Program Cost	14,209,000	18,754,200	24,757,200	32,679,504	43,138,138
PLAN 2	Readers	575,000	690,000	828,000	993,600	1,192,320
	Cost/Reader	24.71+	25.45	26.21	27.00	27.81
	Program Cost	14,209,000	17,560,500	21,701,880	26,827,200	33,158,419
PLAN 3	Readers	575,000	567,226	621,224	677,700	739,288
	Cost/Reader	24.71+	27.18+	29.90+	32.89+	36.18+
	Program Cost	14,209,000	15,417,199	18,574,608	22,289,548	26,747,434
PLAN 4	Readers	575,000	605,784	708,684	825,539	961,792
	Cost/Reader	24.71+	25.45+	26.21+	27.00+	27.81+
	Program Cost	14,209,000	15,417,199	18,574,608	22,289,548	26,747,434
PLAN 5	Readers	575,000	690,000	828,000	993,600	1,192,320
	Cost/Reader	24.71+	27.18	29.90	32.89	36.18
	Program Cost	14,209,000	18,754,200	24,757,200	32,679,504	43,138,138
PLAN 6	Readers	575,000	690,000	828,000	993,600	1,192,320
	Cost/Reader	24.71+	27.18	29.90	32.89	36.18
	Program Cost	14,209,000	18,754,200	24,757,200	32,679,504	43,138,138
PLAN 7	Readers	575,000	690,000	828,000	993,600	1,192,320
	Cost/Reader	24.71+	27.18	29.90	32.89	36.18
	Program Cost	14,209,000	18,754,200	24,757,200	32,679,504	43,138,138
PLAN 8	Readers	575,000	690,000	828,000	993,600	1,192,320
	Cost/Reader	24.71+	25.45	26.21	27.00	27.81
	Program Cost	14,209,000	17,560,500	21,701,880	26,827,200	33,158,419
PLAN 9	Readers	575,000	690,000	828,000	993,600	1,192,320
	Cost/Reader	24.71+	25.45	26.21	27.00	27.81
	Program Cost	14,209,000	17,560,500	21,701,880	26,827,200	33,158,419
PLAN 10	Readers	575,000	690,000	828,000	993,600	1,192,320
	Cost/Reader	24.71+	25.45	26.21	27.00	27.81
	Program Cost	14,209,000	17,560,500	21,701,880	26,827,200	33,158,419
PLAN 11	Readers	575,000	690,000	828,000	993,600	1,192,320
	Cost/Reader	24.71+	25.45	26.21	27.00	27.81
	Program Cost	14,209,000	17,560,500	21,701,880	26,827,200	33,158,419
PLAN 12	Readers	575,000	690,000	828,000	993,600	1,192,320
	Cost/Reader	24.71+	25.45	26.21	27.00	27.81
	Program Cost	14,209,000	17,560,500	21,701,880	26,827,200	33,158,419

NOTES: (1) Each of the twelve (12) plans presented above includes indirect costs determined to be 26.7177%.

(2) The above plans are described in detail on pages 5-2, -6, -7.

(*) Given per DBPH.

Figure 5.5

DIRECT AND INDIRECT AUDIO

COST BY PLAN BY YEAR

COST ELEMENTS	1976	1977	1978	1979	1980
31E Recording	$ 5,092,593	$ 5,917,593	$ 7,725,000	$10,027,315	$13,009,259
31E Other	407,407	473,407	618,000	802,185	1,040,741
31E Sub-Total	5,500,000	6,391,000	8,343,000	10,829,500	14,050,000
31F Equipment	5,266,667	7,813,318	10,446,939	14,014,017	18,788,294
31F Other	263,333	390,666	522,347	700,701	939,415
31F Sub-Total	5,530,000	8,203,984	10,969,286	14,714,718	19,727,709
31G Test Equipment	3,050	5,000	5,000	5,000	5,000
31J Music	180,000	200,000	220,000	240,000	260,000
TOTAL PLAN COST	$11,213,050	$14,799,984	19,537,286	25,789,218	34,042,709
EQUIPMENT PURCHASE (QTY)					
CBM's	61,000	87,000	99,000	123,000	153,000
TBM's	36,000	40,000	60,000	70,000	80,000
RCBM's					
RTBM's					
CM's					
TOTAL PURCHASES	97,000	127,000	159,000	193,000	233,000
RECORD PURCHASE (QTY)					
Flexible Disc Magazines	2,305,000	2,396,000	2,546,000	2,586,000	2,655,000
Flexible Disc books	200,000	200,000	200,000	200,000	200,000
Rigid Disc Books	500,000	50,000			
T.B. Cassette Books	300,000	810,000	1,079,000	1,429,000	1,673,000

ASSUMPTIONS:

- Increase in reader growth 20% per year
- Target population = 2.25 million readers
- Discount rate = 10% on the U.S. dollar
- Equipment includes: CBM, TBM
- Material preference: cassette over flexible disc books

Note: The above quantities and dollar amounts are general approximations to be used as a guide by DBPH in its future budget formulations.

Figure 5.6.1

PLAN 1

COST ELEMENTS	1976	1977	1978	1979	1980
31E Recording	$ 5,092,593	$ 6,074,074	$ 7,037,037	$ 8,000,926	$ 8,963,889
31E Other	407,407	485,926	562,963	640,074	717,111
31E Sub-Total	5,500,000	6,560,000	7,600,000	8,641,000	9,681,000
31F Equipment	5,266,667	6,764,732	8,877,298	11,728,418	15,486,816
31F Other	263,333	338,237	443,865	586,421	774,341
31F Sub-Total	5,530,000	7,102,969	9,321,163	12,314,839	16,261,157
31G Test Equipment	3,050	5,000	5,000	5,000	5,000
31J Music	180,000	190,000	200,000	210,000	220,000
TOTAL PLAN COST	$11,213,050	$13,857,969	$17,126,163	$21,170,839	$26,167,157
EQUIPMENT PURCHASE (QTY)					
CBM's	61,000	46,000			
TBM's	36,000	59,000			
RCBM's		3,000	5,000	5,000	5,000
RTBM's		7,000	81,000	108,000	155,000
CM's		10,000	75,000	95,000	115,000
TOTAL PURCHASES	97,000	125,000	161,000	208,000	275,000
RECORD PURCHASE (QTY)					
Flexible Disc Magazines	2,305,000	2,444,000	2,553,000	2,709,000	2,799,000
Flexible Disc Books	200,000	1,331,000	1,627,000	1,734,000	1,787,000
Rigid Disc Books	500,000	50,000			
T.B. Cassette Books	300,000	450,000	500,000	550,000	600,000

ASSUMPTIONS:

- Increase in reader growth - 20% per year
- Target population = 2.25 million readers
- Cost-effective limit = maximum increase in cost per reader per year of 3%
- Equipment includes: CBM, TBM, RCBM, RTBM; CM
- Material preference: flexible disc over cassette books

Figure 5.6.2

PLAN 2

NOTE: The above quantities and dollar amounts are general approximations to be used as a guide by DBPH in its future budget formulations.

COST ELEMENTS	1976	1977	1978	1979	1980
31E Recording	$ 5,092,593	$ 5,185,185	$ 5,833,333	$ 7,222,222	$ 7,962,963
31E Other	407,407	414,815	466,667	577,778	637,037
31E Sub-Total	5,500,000	5,600,000	6,300,000	7,800,000	8,600,000
31F Equipment	5,266,667	6,069,591	7,770,722	9,128,976	11,707,515
31F Other	263,333	303,480	388,536	456,449	585,376
31F Sub-Total	5,530,000	6,373,071	8,159,258	9,585,425	12,292,891
31G Test Equipment	3,050	3,500	4,000	4,500	5,000
31J Music	180,000	190,000	195,000	200,000	210,000
TOTAL PLAN COST	$11,213,050	$12,166,571	$14,653,258	$17,589,525	$21,107,891
EQUIPMENT PURCHASE (QTY)					
CBM's	61,000	62,000	71,000	76,000	89,000
TBM's	36,000	41,000	48,000	51,000	59,000
RCBM's					
RTBM's					
CM's					
TOTAL PURCHASES	97,000	103,000	119,000	127,000	148,000
RECORD PURCHASE (QTY)					
Flexible Disc Magazines	2,305,000	2,396,000	2,546,000	2,586,000	2,655,000
Flexible Disc Books	200,000	200,000	200,000	200,000	200,000
Rigid Disc Books	500,000	50,000			
T.B. Cassette Books	300,000	652,000	702,000	871,000	849,000

Figure 5.6.3

PLAN 3

ASSUMPTIONS:

- Increase in reader growth not presented at 20% per year
- Discount rate = 10% on U.S. dollar
- Ratio of 3 CBM's to 2 TBM's
- Equipment includes: CBM; TBM
- Material preference: cassette over flexible disc books

NOTE: The above quantities and dollar amounts are general approximations to be used as a guide by DBPH in its future budget formulations.

COST ELEMENTS	1976	1977	1978	1979	1980
31E Recording	$ 5,092,593	$ 5,185,185	$ 5,833,333	$ 7,222,222	$ 7,962,963
31E Other	407,407	414,815	466,667	577,778	637,037
31E Sub-Total	5,500,000	5,600,000	6,300,000	7,800,000	8,600,000
31F Equipment	5,266,667	6,069,591	7,770,722	9,128,976	11,707,515
31F Other	263,333	303,480	388,536	456,449	585,376
31F Sub-Total	5,530,000	6,373,071	8,159,258	9,585,425	12,292,891
31G Test Equipment	3,050	3,500	4,000	4,500	5,000
31J Music	180,000	190,000	195,000	200,000	210,000
TOTAL PLAN COST	$11,213,050	$12,166,571	$14,658,258	$17,589,925	$21,107,891
EQUIPMENT PURCHASE (QTY)					
CBM's	61,000	44,000			
TBM's	36,000	43,000			
RCBM's			38,000	32,000	46,000
RTBM's			36,000	32,000	45,000
CM's		20,000	55,000	70,000	88,000
TOTAL PURCHASES	97,000	107,000	129,000	134,000	179,000
RECORD PURCHASE (QTY)					
Flexible Disc Magazines	2,305,000	2,283,000	2,352,000	2,163,000	2,048,000
Flexible Disc Books	200,000	200,000	200,000	200,000	200,000
Rigid Disc Books	500,000	50,000			
T.B. Cassette Books	300,000	745,000	919,000	1,233,000	1,359,000

ASSUMPTIONS:

- Increase in reader growth not presented as 20% per year
- Cost-effective limit = maximum increase in cost per reader per year of 3%
- Equipment includes: CBM, TBM, RCBM, RTBM: CM
- Material preference: cassette over flexible disc books

NOTE: The above quantities and dollars amounts are general approximations to be used as a guide by DBPH in its future budget formulations.

Figure 5.6.4

PLAN 4

COST ELEMENTS	1976	1977	1978	1979	1980
31E Recording	$ 5,092,593	$ 5,917,593	$ 7,725,000	$10,027,315	$13,009,259
31E Other	407,407	473,406	618,000	802,185	1,040,741
31E Sub-Total	5,500,000	6,391,000	8,343,000	10,829,500	14,050,000
31F Equipment	5,266,667	7,813,318	10,446,939	14,014,017	18,788,294
31F Other	263,333	390,666	522,347	700,701	939,415
31F Sub-Total	5,530,000	8,203,984	10,969,286	14,714,718	19,727,709
31G Test Equipment	3,050	5,000	5,000	5,000	5,000
31J Music	180,000	200,000	220,000	240,000	260,000
TOTAL PLAN COST	$11,213,050	$14,799,984	$19,537,286	$25,789,218	$34,042,709
EQUIPMENT PURCHASE (QTY)					
CBM's	61,000	10,000	25,000	35,000	50,000
TBM's	36,000	162,000	176,000	206,000	242,000
RCBM's					
RTBM's					
CM's					
TOTAL PURCHASES	97,000	172,000	201,000	243,000	292,000
RECORD PURCHASE (QTY)					
Flexible Disc Magazines	2,305,000	2,785,000	3,334,000	4,028,000	4,827,000
Flexible Disc Books	200,000	200,000	200,000	200,000	200,000
Rigid Disc Books	500,000	50,000			
T.B. Cassette Books	300,000	757,000	971,000	1,142,000	1,340,000

ASSUMPTIONS:

- Increase in reader growth - 20% per year
- Discount rate = 10% on the U.S. dollar
- Equipment includes: CBM; TBM
- Material preference: recorded magazines over recorded books

NOTE: The above quantities and dollar amounts are general approximations to be used as a guide by DBPH in its future budget formulations.

Figure 5.6.5

PLAN 5

COST ELEMENTS	1976	1977	1978	1979	1980
31E Recording	$ 5,092,593	$ 5,917,593	$ 7,725,000	$10,027,315	$13,009,259
31E Other	407,407	473,407	618,000	802,185	1,040,741
31E Sub-Total	5,500,000	6,391,000	8,343,000	10,829,500	14,050,000
31F Equipment	5,266,667	7,813,318	10,446,939	14,014,017	18,788,294
31F Other	263,333	390,666	522,347	700,701	939,415
31F Sub-Total	5,530,000	8,203,984	10,969,286	14,714,718	19,727,709
31G Test Equipment	3,050	5,000	5,000	5,000	5,000
31J Music	180,000	200,000	200,000	240,000	260,000
TOTAL PLAN COST	$11,213,050	$14,799,984	$19,537,286	$25,789,218	$34,042,709
EQUIPMENT PURCHASE (QTY)					
CBM's	61,000	103,000	124,000	151,000	185,000
TBM's	36,000	15,000	20,000	25,000	30,000
RCBM's					
RTBM's					
CM's					
TOTAL PURCHASES	97,000	118,000	144,000	176,000	215,000
RECORD PURCHASE (QTY)					
Flexible Disc Magazines	2,305,000	2,364,000	2,404,000	2,467,000	2,510,000
Flexible Disc Books	200,000	200,000	200,000	200,000	200,000
Rigid Disc Books	500,000	50,000			
T.B. Cassette Books	300,000	814,000	1,098,000	1,354,000	1,657,000

ASSUMPTIONS:

Increase in reader growth - 20% per year
- Discount rate - 10% of U.S. dollar
- Equipment includes: CBM; TBM
- Material preference: recorded books over magazines

NOTE: The above quantities and dollar amounts are general approximations to be used as a guide by DBPH in its future budget formulations.

Figure 5.6.6

PLAN 6

COST ELEMENTS	1976	1977	1978	1979	1980
31E Recording	$ 5,092,593	$ 5,917,593	$ 7,725,000	$10,027,315	$13,009,259
31E Other	407,407	473,407	618,000	802,185	1,040,741
31E Sub-Total	5,500,000	6,391,000	8,343,000	10,829,500	14,050,000
31F Equipment	5,266,667	7,813,318	10,446,939	14,014,017	18,788,294
31F Other	263,333	390,666	522,347	700,701	939,415
31F Sub-Total	5,530,000	8,203,984	10,969,286	14,714,718	19,727,709
31G Test Equipment	3,050	5,000	5,000	5,000	5,000
31J Music	180,000	200,000	220,000	240,000	260,000
TOTAL PLAN COST	$11,213,050	$14,799,984	$19,537,286	$25,789,218	$34,042,709
EQUIPMENT PURCHASE (QTY)					
CBM's	61,000	69,000	84,000	102,000	125,000
TBM's	36,000	69,000	84,000	102,000	125,000
RCBM's					
RTBM's					
CM's					
TOTAL PURCHASES	97,000	138,000	168,000	204,000	250,000
RECORD PURCHASE (QTY)					
Flexible Disc Magazines	2,305,000	2,798,000	3,504,000	4,177,000	4,931,000
Flexible Disc Books	200,000	200,000	200,000	200,000	200,000
Rigid Disc Books	500,000	50,000			
T.B. Cassette Books	300,000	755,000	947,000	1,122,000	1,326,000

ASSUMPTIONS:

- Increase in reader growth - 20% per year
- Discount rate - 10% of U.S. dollar
- Average number of current readers of books are twice the number of readers of magazines
- Equipment includes: CBM; TBM
- Material preference: magazines and cassette books equally

Figure 5.6.7

PLAN 7

NOTE: The above quantities and dollar amounts are general approximations to be used as a guide by DBPH in its future budget formulations.

COST ELEMENTS	1976	1977	1978	1979	1980
31E Recording	$ 5,092,593	$ 6,074,074	$ 7,037,037	$ 8,000,926	$ 8,963,889
31E Other	407,407	485,926	562,963	640,074	717,111
31E Sub-Total	5,500,000	6,560,000	7,600,000	8,641,000	9,681,000
31F Equipment	5,266,667	6,764,732	8,877,298	11,728,418	15,486,816
31F Other	263,333	338,237	443,865	586,421	774,341
31F Sub-Total	5,530,000	7,102,969	9,321,163	12,314,839	16,261,157
31G Test Equipment	3,050	5,000	5,000	5,000	5,000
31J Music	180,000	190,000	200,000	210,000	220,000
TOTAL PLAN COST	$11,213,050	$13,857,969	$17,126,163	$21,170,839	$26,167,157
EQUIPMENT PURCHASE (QTY)					
CBM's	61,000	50,000			
TBM's	36,000	50,000			
RCBM's			52,000	65,000	84,000
RTBM's			51,000	67,000	84,000
CM's		20,000	51,000	66,000	85,000
TOTAL PURCHASES	97,000	120,000	154,000	198,000	253,000
RECORD PURCHASE (QTY)					
Flexible Disc Magazines	2,305,000	3,183,000	3,658,000	3,988,000	4,139,000
Flexible Disc Books	200,000	200,000	200,000	200,000	200,000
Rigid Disc Books	500,000	50,000			
T.B. Cassette Books	300,000	863,000	999,000	1,076,000	1,137,000

Figure 5.6.8

PLAN 8

ASSUMPTIONS:

- Increase in reader growth - 20% per year
- Cost-effective limit = maximum increase in cost per year per reader of 3%
- Two magazines provided for every cassette book
- Equipment includes: CBM, TBM, RCBM, RTBM; CM
- Material preference: magazines and cassette books equally

NOTE: The above quantities and dollar amounts are general approximations to be used as a guide by DBPH in its future budget formulations.

COST ELEMENTS	1976	1977	1978	1979	1980
31E Recording	$ 5,092,593	$ 6,074,074	$ 7,037,037	$ 8,000,926	$ 8,963,889
31E Other	407,407	485,926	562,953	640,074	717,111
31E Sub-Total	5,500,000	6,560,000	7,600,000	8,641,000	9,681,000
31F Equipment	5,266,667	6,764,732	8,877,298	11,728,418	15,486,816
31F Other	263,333	338,237	443,865	586,421	774,341
31F Sub-Total	5,530,000	7,102,969	9,321,163	12,314,839	16,261,157
31G Test Equipment	3,050	5,000	5,000	5,000	5,000
31J Music	180,000	190,000	200,000	210,000	220,000
TOTAL PLAN COST	$11,213,050	$13,857,969	$17,126,163	$21,170,839	$26,167,157
EQUIPMENT PURCHASE (QTY)					
CBM's	61,000	20,000			
TBM's	36,000	109,000			
RCBM's		10,000	51,000	66,000	84,000
RTBM's		10,000	154,000	198,000	254,000
CM's					
TOTAL PURCHASES	97,000	149,000	205,000	264,000	338,000
RECORD PURCHASE (QTY)					
Flexible Disc Magazines	2,305,000	2,770,000	3,299,000	4,011,000	4,725,000
Flexible Disc Books	200,000	250,000	300,000	350,000	400,000
Rigid Disc Books	500,000	50,000			
T.B. Cassette Books	300,000	897,000	1,003,000	1,004,000	964,000

Figure 5.6.9

PLAN 9

ASSUMPTIONS:

- Increase in reader growth - 20% per year
- Cost-effective limit = maximum increase in cost per reader per year of 3%
- Three RTBM's provided to one RCBM
- R&D program did not lead to a desirable CM
- Equipment includes: CTBM, TBM, RCBM; RTBM
- Material preference: recorded magazines over recorded books

NOTE: The above quantities and dollar amounts are general approximations to be used as a guide by DBPH in its future budget formulations.

COST ELEMENTS	1976	1977	1978	1979	1980
31E Recording	$ 5,092,593	$ 6,074,074	$ 7,037,037	$ 8,000,926	$ 8,963,889
31E Other	407,407	485,926	562,963	640,074	717,111
31E Sub-Total	5,500,000	6,560,000	7,600,000	8,641,000	9,681,000
31F Equipment	5,266,667	6,764,732	8,877,298	11,728,418	15,486,816
31F Other	263,333	338,237	443,865	586,421	774,341
31F Sub-Total	5,530,000	7,102,969	9,321,163	12,314,839	16,261,157
31G Test Equipment	3,050	5,000	5,000	5,000	5,000
31J Music	180,000	190,000	200,000	210,000	220,000
TOTAL PLAN COST	$11,213,050	$13,357,969	$17,126,163	$21,170,839	$26,167,157
EQUIPMENT PURCHASE (QTY)					
CBM's	61,000	50,000			
TBM's	36,000	50,000			
RCBM's			75,000	100,000	133,000
RTBM's			75,000	101,000	133,000
CM's		20,000	20,000	20,000	20,000
TOTAL PURCHASES	97,000	120,000	170,000	221,000	286,000
RECORD PURCHASE (QTY)					
Flexible Disc Magazines	2,305,000	3,184,000	3,658,000	3,988,000	4,139,000
Flexible Disc Books	200,000	200,000	200,000	200,000	200,000
Rigid Disc Books	500,000	50,000			
T.B. Cassette Books	300,000	863,000	999,000	1,076,000	1,137,000

Figure 5.6.10

PLAN 10

ASSUMPTIONS:

- Increase in reader growth - 20% per year
- Cost-effective limit = maximum increase in cost per reader per year of 3%
- Equipment includes: CBM, TBM, RCBM, RTBM; CM
- Material preference: magazines and cassette books equally

NOTE: The above quantities and dollar amounts are general approximations to be used as a guide by DBPH in its future budget formulations.

COST ELEMENTS	1976	1977	1978	1979	1980
31E Recording	$ 5,092,593	$ 6,074,074	$ 7,037,037	$ 8,000,926	$ 8,963,889
31E Other	407,407	485,926	562,963	640,074	717,111
31E Sub-Total	5,500,000	6,560,000	7,600,000	8,641,000	9,681,000
31F Equipment	5,266,667	6,764,732	8,877,298	11,728,418	15,486,816
31F Other	263,333	338,237	443,865	586,421	774,341
31F Sub-Total	5,530,000	7,102,969	9,321,163	12,314,839	16,261,157
31G Test Equipment	3,050	5,000	5,000	5,000	5,000
31J Music	180,000	190,000	200,000	210,000	220,000
TOTAL PLAN COST	$11,213,050	$13,857,969	$17,126,163	$21,170,839	$26,167,157
EQUIPMENT PURCHASE (QTY)					
CBM's	61,000				
TBM's	36,000				
RCBM's					
RTBM's					
CM's		94,000	120,000	153,000	197,000
TOTAL PURCHASES	97,000	94,000	120,000	153,000	197,000
RECORD PURCHASE (QTY)					
Flexible Disc Magazines	2,305,000	2,540,000	2,772,000	3,089,000	3,336,000
Flexible Disc Books	200,000	1,412,000	1,670,000	1,729,000	1,733,000
Rigid Disc Books	500,000	50,000			
T.B. Cassette Books	300,000	400,000	450,000	500,000	550,000

ASSUMPTIONS:

- Increase in reader growth - 20% per year
- Target population = 2.25 million readers
- Cost-effective limit = maximum increase in cost per reader per year of 3%
- After FY 1976 equipment purchases include only the CM
- Material preference: flexible disc over cassette books

Figure 5.6.11

PLAN 11

NOTE: The above quantities and dollar amounts are general approximations to be used as a guide by DBPH in its future budget formulations.

COST ELEMENTS	1976	1977	1978	1979	1980
31E Recording	$ 5,092,593	$ 6,074,074	$ 7,037,037	$ 8,000,926	$ 8,963,889
31E Other	407,407	485,926	562,963	640,074	717,111
31E Sub-Total	5,500,000	6,560,000	7,600,000	8,641,000	9,681,000
31F Equipment	5,266,667	6,764,732	8,877,298	11,728,418	15,486,816
31F Other	263,333	338,237	443,865	586,421	774,341
31F Sub-Total	5,530,000	7,102,969	9,321,163	12,314,839	16,261,157
31G Test Equipment	3,050	5,000	5,000	5,000	5,000
31J Music	180,000	190,000	200,000	210,000	220,000
TOTAL PLAN COST	$11,213,050	$13,857,969	$17,126,163	$21,170,839	$26,167,157
EQUIPMENT PURCHASE (QTY)					
CBM's	61,000	64,000			
TBM's	36,000	63,000			
RCBM's					
RTBM's					
CM's			120,000	153,000	197,000
TOTAL PURCHASES	97,000	127,000	120,000	153,000	197,000
RECORD PURCHASE (QTY)					
Flexible Disc Magazines	2,305,000	2,540,000	2,772,000	3,089,000	3,336,000
Flexible Disc Books	200,000	1,412,000	1,670,000	1,729,000	1,733,000
Rigid Disc Books	500,000	50,000			
T.B. Cassette Books	300,000	400,000	450,000	500,000	550,000

Figure 5.6.12

PLAN 12

ASSUMPTIONS:

- Increase in reader growth - 20% per year
- Target population = 2.25 million readers
- Cost-effective limit = maximum increase in cost per reader per year of 3%
- After FY 1977 equipment purchases include only the CM
- Material preference: flexible disc over cassette books

NOTE: The above quantities and dollar amounts are general approximations to be used as a guide by DBPH in its future budget formulations.

Line Item 12 - (Personnel Benefits)

The personnel benefit percentages, currently used by DBPH were maintained.

Line Item 21 - (Travel)

An increase in the number of readers requires an increase in the travel budget.

Line Item 22 - (Transportation of Things)

There will be an increase in promotion and more presentations and displays will be required at conventions, schools and institutions.

Line Item 23 - (Communications)

This item will increase as the amount of readers increases.

Line Item 24 - (Printing)

Printing costs will increase proportionately to the increase in readers and the costs of paper. DBPH will also be updating new mailing lists for readers, to be used by the book and magazine producers.

Line Item 25A - (Other Contractual Services)

DBPH is committed to an information management system, including inventory control, document control, mailing lists, bibliographic control, etc. This item should also include field malfunction reporting and the results of reader tests as well as data on maintenance support provided at multi-state centers.

Line Item 25E - (Training)

Additional on-the-job and formal training programs are needed for both the technical and data processing staff.

Line Item 25F - (Professional & Consultant Services)

The additional development of financial models and cost/benefit models should be covered by this item of the budget, as well as the use of technical consultants.

Line Item 25H - (Publication Contracts)

An increase in the promotional activities is needed to be able to obtain the required reader growth.

Line Item 25J - (Research & Development)

This item reflects the increases in the R&D and test costs previously defined.

Line Item 26 - (Needles)

Spare and replacement needles will still be purchased at a continuous rate because they will still fail frequently in the field.

Line Item 31E - (Sound Recordings)

See detailed Figures 5.1 and 5.2 for the assumptions used.

Line Item 31F - (Sound Equipment)

See detailed Figure 5.3 for the assumptions used.

Line Item 31G (Test Equipment)

The test equipment in the field will have to increase because of the amount of readers and the possible use of libraries to inspect the cassettes. Test equipment will also be needed in DBPH as well as at the multi-state centers. The volunteers may also require some support.

Figure 5.7 provides a detailed budget presentation of Plan 2 which is recommended as the optimum budget. In Section 6 an analysis will be made to determine if it provides the optimum cost/benefit ratio to the readers.

5.3.5 Cost/Volume Ratio

The study evaluated whether or not the production of the cassettes can achieve a similar cost/volume ratio to flexible discs. The visits to both the cassette and the flexible disc manufacturers provided the conclusion that the maximum cost advantage for cassettes occurs in the range of 1000 to 2000 cassettes and that under 1000 the price is significantly higher. There is no advantage in purchasing cassettes in higher quantities either. The copying techniques for cassettes do not favor large volume production, while the stamping of large quantities of flexible discs has a decided cost advantage.

There is a considerable amount of labor involved in cassette manufacturing, especially when using the King Loaders where the tape is spliced to the leader. In the case of the flexible disc, the entire process is highly automated and the choice of how many units can be made with a significant price reduction is based entirely upon the number of stampers needed for each large production run.

In the case of a flexible disc, it is possible to obtain between 60 minutes and 75 minutes of recording using a method of record cutting designed for playback with a .0007" stylus. Therefore, on one flexible disc one can get easily two hours of recorded voice, and it would take approximately six discs to record one book.

Given varying prices by different manufacturers for the flexible disc and if the more conservative figures were used, it can be estimated that one disc

NO.	LINE ITEMS	1976	1977	1978	1979	1980
11	Salaries & Compensation	$ 1,348,816	$ 1,622,752	$ 1,947,303	$ 2,336,765	$ 2,804,116
12	Personnel Benefits	112,081	172,633	207,160	248,592	298,310
21	Travel	44,350	60,000	90,000	115,400	145,680
22	Transportation of Things	7,500	8,500	10,200	12,000	16,000
23	General Expenses	109,000	130,800	156,960	188,352	246,022
24	Printing and Duplication	149,823	179,787	205,744	258,893	330,671
25A	Other Contractual Services	415,000	550,000	600,000	720,000	860,000
25C	Health Services	300	300	300	300	300
25E	Training	5,000	10,000	15,000	25,000	25,000
25F	Professional & Consulting	12,000	15,600	30,280	56,364	74,273
25G	Repair to Machines	72,500	90,000	115,000	158,900	179,992
25H	Publication Contracts	677,880	764,807	962,000	1,171,000	1,346,157
25J	Research & Development	200,000	250,000	337,000	340,000	415,000
26	Office Supplies	187,000	210,000	271,551	345,000	415,000
31D	Books in Raised Characters	1,292,700	1,357,335	1,395,202	1,605,077	1,857,838
31E	Sound Recordings	5,500,000	6,560,000	7,600,000	8,641,000	9,681,000
31F	Procurement of Machines	5,530,000	7,102.969	9,321,163	12,314,839	16,261,157
31G	Testing Equipment	3,050	5,000	5,000	5,000	5,000
31J	Music	180,000	190,000	200,000	210,000	220,000
	Contingency Funds	---	---	---	108,635	331,113
	TOTAL	$15,847,000	$19,280,483	$23,469,863	$28,861,117	$35,512,629

Figure 5.7

PLAN 2 BUDGET BY LINE ITEM

The dollars shown in the "Preliminary Model - Plan 2 Budget by Line Item" presented above incorporate the dollars necessary to accomplish the recommendations made earlier in this section and is also used to illustrate that the tasks can be performed within the funding provided by the 26.7177% overhead rate. The judgment factors per line item affected by the increases in requirements for the audio services program are shown on pages 5-14, -28, and -29. It is not possible to estimate accurately the decisions to be made in areas other than the audio services program of DBPH activity. Contingency funds are defined to include excess dollars (within the 26.7177% allocation) available to be used at the discretion of DBPH in future years.

would cost $.20 a copy, less packaging costs, for quantities between 2000 and 5000. In quantities of 10,000 (which is unlikely), DBPH can achieve prices close to $.17 a copy. These six records at $.20 a copy for the popular books would cost DBPH $1.20 for each copy. APH and Eva-Tone estimated that under controlled conditions, one can get 250 playings of a flexible disc. The present specifications only require three playings but could be raised to 50 if field tests proved that this were true.

Using the out-of-cassette approach to manufacture cassette books as compared to the in-cassette approach, DBPH can assume that in comparable quantities of 2000 to 5000, they can get cassettes recorded at $.75 - $.85 a copy. If DBPH used an $.85 high-quality cassette on 4-track, it would take two cassettes to produce an equivalent book. Therefore, by multiplying $.85 by 2, it will cost $1.70 for the equivalent recording. In addition, DBPH has to add a minimum of $.21 for labeling and a significant amount of money for packaging ($1.00).

DBPH therefore has to decide if increasing the readers warrants a reconsideration of their policy of only restricting books to cassettes if cost makes a difference. In very small quantities, it is obvious that the cassette has a decided cost advantage over the flexible disc.

SECTION 6

DISBENEFIT/COST ANALYSIS

6.1 Introduction

This section contains the ranking of the desirability of the various plans proposed in Section 5. The decision to undertake this analysis was based on the proposition that this public investment (or choice between investments) is not a moral decision but is set within a cost accounting framework, much the same way as any other investment decision. In this section a comparison is made of the attributed costs and benefits over the five-year period of 1976 - 1980, and the cost/benefit ratio is used to rank the various plans.

A few words must be said in explanation of the special character of this analysis. The benefits to readers of the DBPH Audio Services Program have not been measured, as is usually the case. This number was too dificult to quantify and too abstract to be meaningful. Therefore, a decision was made to measure disbenefits - the negative aspects of the system.

In other words, it was found that the various levels of disbenefits, the "aggravation level", can be measured in a very meaningful manner. Simply stated, whenever a reader, for any of several specific reasons, is unable to read his book, he suffers a disbenefit. The amount of disbenefit is equivalent to the value of the system he uses. This value is taken to be the monetary cost of supplying the reader with a service and provides an accurate quantification of the disbenefits of each implementation plan.

The following will describe the disbenefit analysis and cost analysis methodologies and, finally, the disbenefit/cost rankings for each implementation plan. The cost data for each plan can be found in Figure 5.4.

6.2 Disbenefit Analysis

Specific areas in which disbenefits vary as a function of the implementation plans are defined as:

- a lack of equipment due to machine breakdown
- a lack of reading material due to:
  - book damage
  - lack of sufficient titles or copies

These areas are discussed in depth in the following subsections.

Several of the special terms used throughout the discussion are:

- Disbenefit Cost to Reader (C) - defined in number of dollars per five reader-years. This is arrived at by dividing the total program cost into the total number of expected readers. Five reader-years is equivalent to one reader reading for five years. The value of the service is set equal to the money put into it. The following values of C were used for the plans indicated:

Plans 1, 5, 6, & 7	$87.44
Plans 2, 8, 9, 10, 11, & 12	$74.23

- Machine Density (MD) - for the analysis, a constant value of .7 machines/reader was used.
- Frequency of Reading (F) - defined as the average number of books read by each reader per year. This is another constant at 22 books/reader-year or .42 books/reader week.

It should be noted that Plans 3 and 4 have been omitted from the analysis. These plans do not reach the desired readership levels and were considered, a priori, to be inadequate. Therefore, in comparing the various plans to an essentially "no change" situation, Plan 1 should be considered as the plan to reach DBPH's desired population without implementing any new changes in technology. If DBPH does nothing more than request increases in budgets to reach the 20% growth rate in readers, then the Plan 1 analysis will predict the disbenefits of such an action.

6.2.1 Lack of Equipment

The following scale was used to determine the expected malfunctions of machines utilized in the DBPH program. It was developed using the best available data from DBPH personnel and manufacturers.

1. Current TBM (10 years or older) - 50% irreparable breakdowns/year
2. Current TBM (10 years or older) - 10% reparable breakdowns/year
3. Current TBM - 5% reparable breakdowns/year
4. Current CBM - 5% reparable breakdowns/year
5. Revised TBM - 1% reparable breakdowns/year
6. Revised CBM - 1% reparable breakdowns/year
7. CM - 5% reparable breakdowns/year

These rates were used to determine the expected number of malfunctions of the various numbers of machines purchased under each plan. The expected number of malfunctions in any year is determined by adding the expected values for machines purchased in that year and the expected value for machines previously purchased, as shown in the following formula:

E(i) = malfunction rate x number of machines bought + malfunction rate x number of machines on-hand = total number of annually expected incidences of malfunction.

Table 6.1 shows a breakdown of the revised and current machines to be made available for each plan.

Table 6.1

AVAILABILITY OF MACHINES*

Plan	New Machines Available for Replacement	Old Machines Still In Use
1	310,376	66,624
2	367,376	9,624
5	506,376	---
6	251,376	125,624
7	358,376	18,624
8	323,376	53,624
9	554,376	---
10	395,376	---
11	162,376	13,824 (10 yrs +) 176,200 (10 yrs -)
12	195,376	181,624

*Column 2, "New Machines Available for Replacement," is the residual total procurement minus machines needed for new members. These machines will be used to retire 200,800 machines which are expected to be more than 10 years old by 1980. Any old machines remaining are shown in Column 3, "Old Machines Still in Use."

It should be noted that procurements for Plans 5, 9, and 10 allow for retirement of all machines in current use. Plan 11 includes machines as old as and older than 10 years, with a notably increased probability of malfunctions.

A determination was made of the reading time lost in waiting for machine replacement or repair. There are two alternatives to handling a machine malfunction:

1. The reader contacts the lending agency, and a replacement machine is sent immediately. Time lost: 1 - 1.5 weeks. This has been determined to occur in about 20% of all cases.

2. The reader must return the broken machine and wait for its repair. Time lost: 4 weeks. This occurs about 80% of the time.

The weighted average for the time lost is equal to 2.65 weeks. This value was assumed constant for each plan over the length of the program.

It was determined from previous procurements that, of the number of machines operating in FY 1975, 200,800 machines would be over 10 years old and 176,200 would be less than 10 years old by 1980.

Using .7 for MD it was found that 498,624 machines would be needed over the five years to satisfy increasing reader levels. From this, the expected number of machine malfunctions was calculated. The total disbenefits were derived by the following formula:

D(1.1) = Expected machine failures x weeks waiting x C x one/MD.

Table 6.2 shows the numbers of expected machine malfunctions and disbenefit values for each plan.

6.2.2 Dissatisfaction Due to Book Damage

The next phase of the disbenefit analysis examined what happens when the reader gets the book he requests. Data from the "Interim Report - Cassette Damage - - Field Survey" for September 1973 was used:

	Average Frequency
Cassettes Damaged	11.70%
Cassettes Missing	3.58%
Wrong or Extra Cassette Found	1.12%

In the case of the talking book, the damage value was lowered to 1%. If a disc is damaged (scratched or warped), moving the needle forward will usually solve the problem. Only a sentence or paragraph need be lost. Disbenefit taken in lost reading time is negligible. The 1% value includes badly damaged records that cannot be played. It was assumed, in line with DBPH experience that only one problem will occur per book.

Table 6.2

EXPECTED MACHINE MALFUNCTIONS AND DISBENEFITS*

Plan	Expected Machine Malfunctions	Disbenefits ($)
1	47,112	15,595,148
2	29,502	8,290,462
5	50,250	16,633,898
6	50,032	16,561,734
7	44,712	14,800,692
8	30,342	8,526,513
9	19,570	5,499,435
10	20,020	5,625,891
11	57,582	16,181,322
12	52,862	14,854,938

*Column 2, "Expected Machine Malfunctions," is based on the types of machines in use and their associated malfunction rate. These numbers were incorporated into the equation for D(1.1) to yield Column 3, "Disbenefits."

It should be noted that those plans showing heavy investment in RTBM and RCBM (with their low malfunction rates) result in low expected machine malfunction rates and, consequently, low values for disbenefits. Using this criterion, Plan 9 is the preferred plan in spite of the large procurement involved. Plans with heavy investment in combination machines (Plans 11 & 12) show high disbenefit values even though they represent cost-effective plans with relatively low procurement quantities involved.

For talking book records, the following data was used:

	Average Frequency
Records Damaged	1.00%
Records Missing	3.58%
Wrong or Extra Record Found	1.12%

In the case of the flexible disc book, the following figures were used:

	Average Frequency
Discs Damaged	1.00%
Discs Missing	0.00%
Wrong or Extra Discs Found	0.00%

The binding of the flexible disc book precludes omissions of discs and inclusion of superfluous discs.

The data are combined in Table 6.3.

Disbenefits are given by the following equation:

$$D(2.1) \quad = \quad \text{Expected books damaged} \quad \times \quad \text{one}/F \quad \times \quad C.$$

Values for the numbers of expected books damaged and the associated disbenefits are shown in Table 6.4.

6.2.3 Lack of Reading Material Due to Unavailability of Copies

This portion covers the area of the study most difficult to quantify: reader satisfaction due to the quality and quantity of book selection. Good data in this area is either scarce or nonexistent. The subject in question was narrowed by considering the lack of material from the perspective of the number of copies available to the reader. This is based on the fact that it is common policy, in lieu of accurate data on reader preferences, for regional libraries to supply books by subject area more often than by title. This lack of title specificity creates the necessity of the consideration of this problem from a copies-per-reader perspective. The number of copies of books available by 1980 was then calculated by adding the procurement of the next five years to the current value of 3,145,000, as given by DBPH. This is shown in Table 6.5.

6.3 Plan Ranking

6.3.1 Disbenefit/Cost Ratio

The first analysis involves the standard disbenefit/cost ratio. This requires the summation of the disbenefits and the division of the sum by the readers

Table 6.3

FREQUENCY OF OCCURRENCE OF SOURCES OF DISBENEFIT IN THE USE OF TALKING BOOKS*

	Flexible Disc	Hard Disc	Cassette
Books Damaged	1%	1.00%	11.70%
Books Missing	0%	3.58%	3.58%
Wrong or Extra Found	0%	1.12%	1.12%

*This table illustrates the fact that the damaged cassette books can be the most serious potential problem in the potential availability and utilization of recorded materials by the reader and that, if sufficient TBM's or CM's are available, there will be a higher utilization factor for discs.

Table 6.4

DISBENEFITS DUE TO BOOK DAMAGE*

Plan	Expected Books Damaged	Disbenefits ($)
1	909,074	3,974,471
2	491,740	1,825,093
5	780,990	3,414,488
6	897,922	3,915,837
7	771,150	3,317,692
8	758,850	2,816,471
9	729,902	2,709,031
10	758,850	2,815,333
11	459,590	1,705,078
12	459,590	1,705,078

*Column 2, "Expected Books Damaged," is compiled using the procurement data and their associated damage rates. The factoring by the appropriate damage values from the equation D(2.1) yielded the disbenefits of Column 3.

Using this criterion, Plans 2, 11, and 12 are preferred. This is due to the influence of high flexible disc investment with their low damage rates (as evidenced by the low values for expected books damaged) and the cost-effectiveness of the implementation.

Table 6.5

TOTAL COPIES*

Plan	Number of Copies
1	9,986,000
2	12,774,000
5	9,205,000
6	9,918,000
7	9,145,000
8	9,070,000
9	9,360,000
10	9,070,000
11	12,639,000
12	12,639,000

*This table shows the total number of all types of books achievable under each plan based on procurements. The data are essentially bi-modal. The most preferable plans (Plans 2, 11, and 12) have the advantage of flexible discs providing numbers of copies. Disbenefits were intentionally not calculated since they cannot be considered meaningful. However, the plans can be ranked according to the total number of copies available to readers, with the assumption that the more copies of books are in circulation, the less dissatisfaction will be experienced by readers. Ranking was done in a second analysis.

to be served. The results are shown in Table 6.6. The costs were taken from Figure 5.4. (Disbenefit/cost ratios are calculated in Table 6.7 and shown in Figure 6.1.) This analysis permits a rank ordering of the plans according to their desirability. This appears in Table 6.7 showing Plan 9 to be the most desirable. Figure 6.1 graphically represents the same data, indicating a clear preferability of Plans 9, 10, 2, and 8. Here the reader costs are plotted as a function of reader disbenefits for each plan, so that plan desirability varies inversely with the height of the slope plotted.

To cross-check these results, a second analysis was performed.

6.3.2 Average Ranking Analysis

In order to gain another perspective on preferred plans, a disbenefit analysis was devised ranking each plan according to types of disbenefits generated (machine malfunctions, book damage, total copies of books available), and an average ranking was tabulated. These values appear in Table 6.8. Under this scheme, Plan 2 is preferred, followed by Plans 12, 11, and 9.

The final column on Table 6.8 shows the average deviation from the average rank. This indicates a measure of the ranking consistency of a plan over all categories. The preferred Plan 2 is the most consistent and Plan 12 is less so. Plan 9 is more consistent than Plan 11.

6.4 Conclusions

Two methods for ordering preferences of the implementation plans are presented. The results are shown in Table 6.9. Obviously, each method had to be evaluated to determine which yielded more realistic results. Specifically, the assumptions made in the analysis and their implications were reevaluated.

This analysis was based on the initial assumption that machine density will be constant at .7 machines/reader. This value was used to carry out the analysis, yet there is no a priori way of knowing how many readers a given number of machines will reach. This will vary due to the size of deposit collections and the number of readers requesting, and getting, two machines (a function of their preference for cassette books vs. flexible disc magazines or both).

It follows, then, that those plans that do not emphasize CM's will require a higher machine density (if it is assumed that any number of readers desire cassette books and flexible disc magazines) than those plans emphasizing CM's if all readers are to be satisfied. The target population to be reached would be lowered with a higher machine density, given a constant level of dissatisfaction. To reach the target population, the machine density would have to be lowered and dissatisfaction would therefore rise.

Preference lists were then examined, and it was found that the average ranking analysis yielded more realistic results based on the above logic.

Table 6.6

TOTAL DISBENEFITS DUE TO MACHINE AND BOOK MALFUNCTION VS TOTAL COSTS*

Plan	Total Disbenefits	Disbenefits Per Reader	Total Costs Per Reader
1	$ 19,569,619	$ 16.41	$ 87.44
2	10,115,555	8.48	74.23
5	20,048,386	16.81	87.44
6	20,477,571	17.17	87.44
7	18,118,384	15.20	87.44
8	11,342,984	9.51	74.23
9	8,208,466	6.88	74.23
10	8,441,224	7.08	74.23
11	17,886,400	15.00	74.23
12	16,560,016	13.89	74.23

*Column 2 represents the disbenefits summed from Tables 6.2 and 6.4. Column 3 expresses this in per reader (per capita) form. Column 4 shows the total cost per reader taken from Figure 5.4.

Table 6.7

DISBENEFIT/COST RATIO AND RANK*

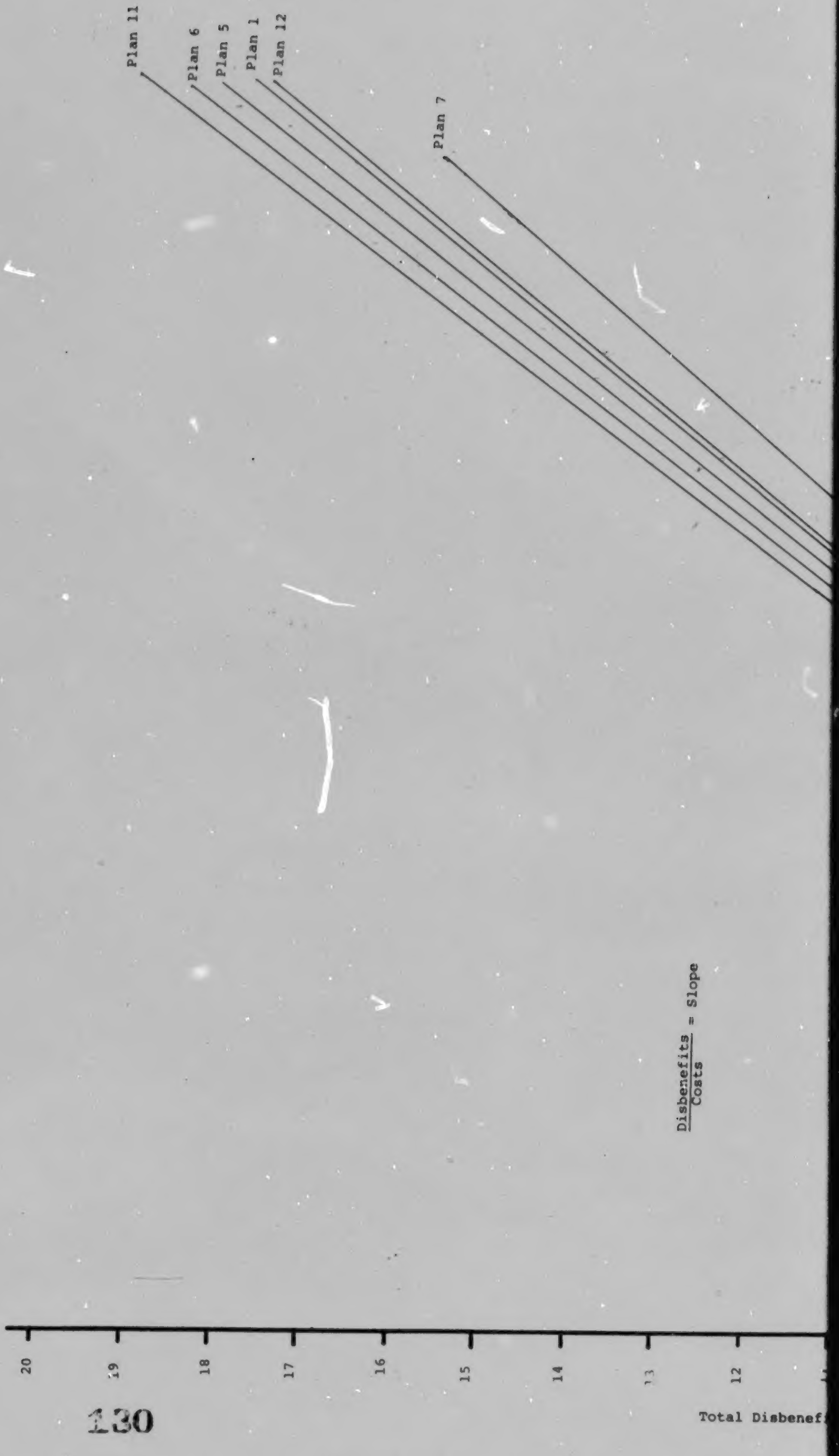
Plan	Ratio	Rank
1	.1877	7
2	.1142	3
5	.1922	8
6	.1964	9
7	.1738	5
8	.1281	4
9	.0927	1
10	.0954	2
11	.2021	10
12	.1871	6

*The disbenefit/cost ratio is the value of:

$$\frac{\text{Disbenefits Per Reader (Column 3, Table 6.6)}}{\text{Costs Per Reader (Column 4, Table 6.6)}}$$

These values are then ranked. The ranking appears pictorially in Figure 6.1, where lower slope denotes a lower disbenefit/cost ratio (or increased desirability).

From the graph it is clear that Plans 9, 10, 2, and 8 are distinctly preferred to the rest. These findings lead to a second analysis to examine the validity of this claim.


Plan 11
Plan 6
Plan 5
Plan 1
Plan 12
Plan 7
$\frac{\text{Disbenefits}}{\text{Costs}}$ = Slope
20
19
18
17
16
15
14
13
12
Total Disbenef

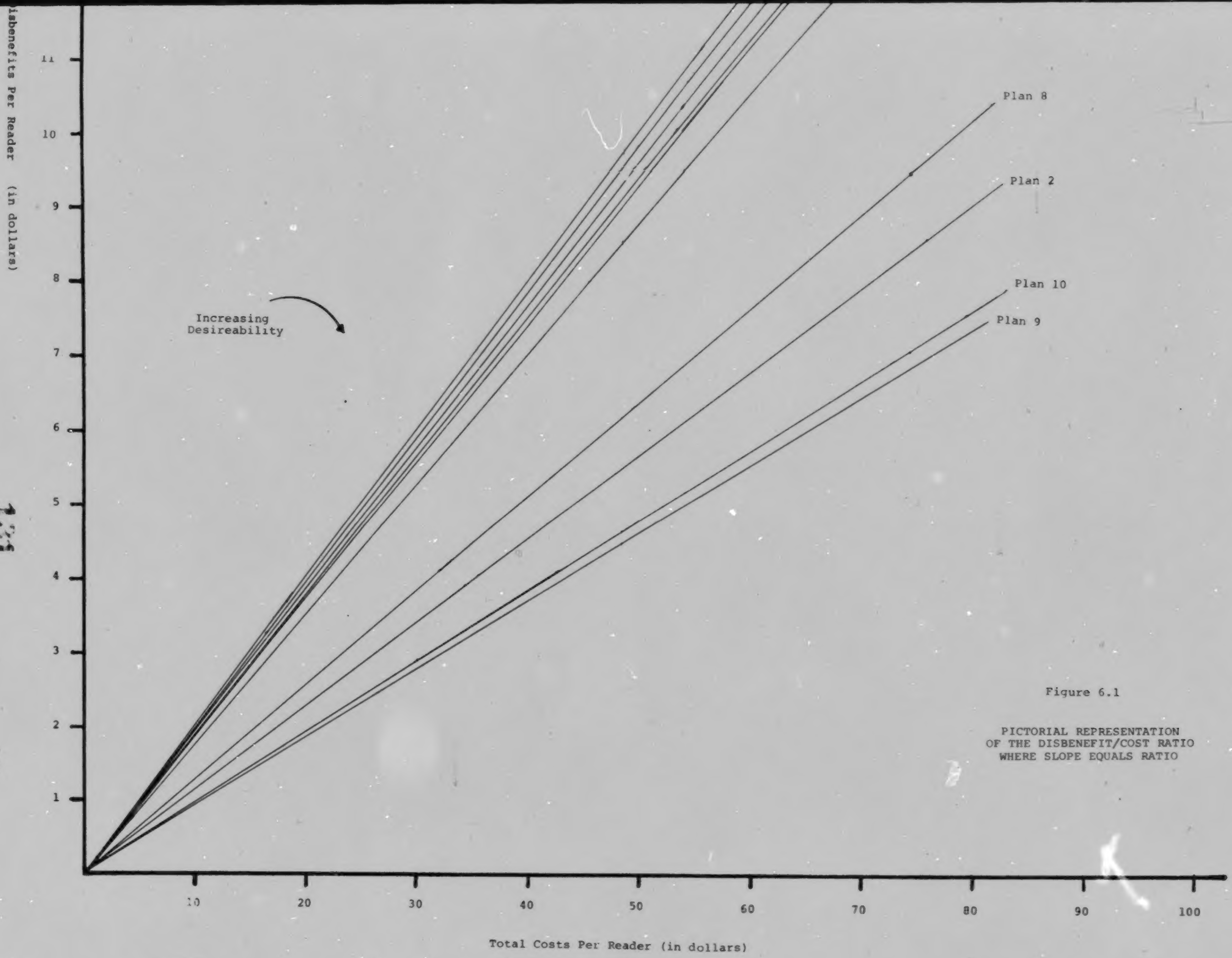


Figure 6.1

PICTORIAL REPRESENTATION
OF THE DISBENEFIT/COST RATIO
WHERE SLOPE EQUALS RATIO

Table 6.8

AVERAGE RANKING OF PLANS*

Plan	Ranked Machine Malfunction Disbenefits	Ranked Book Damage Disbenefits	Ranked Copies Available	Average Rank	Ranked Averages	Average Deviation
1	7	10	4	7	8	2.00
2	3	3	1	2.33	1	.89
5	10	8	7	8.33	10	1.11
6	9	9	5	7.67	9	1.78
7	5	7	8	6.67	7	1.11
8	4	6	9	6.33	6	1.78
9	1	4	6	3.67	3	1.78
10	2	5	9	5.33	5	2.44
11	8	1.5	2.5	4.00	4	2.67
12	6	1.5	2.5	3.33	2	1.78

*Columns 2, 3, and 4 rank in order of magnitude the disbenefits and copies of books totals from Tables 6.2, 6.4, and 6.5. An average was taken and these averages ranked in Column 6. Column 7, the average deviation, was derived by taking the average absolute difference of each rank order from the average rank.

Table 6.9

COMPARISON OF PLANS IN ORDER OF PREFERENCE BY BOTH METHODS OF ANALYSIS*

	Analysis of Disbenefits/Cost Ratio	Analysis using Average Ranking
Preferred	9	2
	10	12
	2	9
	8	11
	7	10
	12	8
	1	7
	5	1
	6	6
Not Preferred	11	5

*The first analysis shows that Plan 9 is the best if a straight disbenefits/cost ratio is used. If average ranking is used, Plan 2 is the most preferred, and this is the plan recommended for implementation by DBPH.

Equipment purchases for Plans 2, 8, 9, 10, 11, and 12 are presented below:

Plan	CBM	TBM	RCBM	RTBM	CM
2	107,000	95,000	18,000	351,000	295,000
8	111,000	86,000	201,000	202,000	222,000
9	81,000	145,000	211,000	616,000	-
10	111,000	86,000	308,000	309,000	80,000
11	61,000	36,000	-	-	564,000
12	125,000	99,000	-	-	470,000

The average ranking analysis gives plans for first, second, and fourth choices that heavily invest in CM's. The disbenefit/cost ratio analysis gives plans for first, second, and fourth choices that are weak in CM investment. It has been concluded, therefore, that the average ranking analysis gives a more realistic ranking of preferences for DBPH and that the final choice of an implementation plan should be made using this method. Plan 2 becomes the unambiguous preferred implementation plan.

SECTION 7

THE CONVERSION PLAN

7.1 The Optimum Plan

The analysis provided in the technical, financial, and cost/benefit portions of this report clearly defined Plan 2 as the optimum conversion program. A summary of the factors evaluated in making this decision is presented below.

PLAN 2

THE RECOMMENDED AUDIO SERVICES CONVERSION PLAN
(Summarized for Five Year Period)

CAPABILITY RELATED TO QUANTITY/COST RELATIONSHIP

Description	Quantity/Cost Relationship
Overall Program Cost	$ 88,512,000
Number of Readers	1,192,320 Readers
New Equipment Purchased	866,000 Units
Equipment Complement	
. Current Talking Book Machines	95,000 Units
. Current Cassette Book Machines	107,000 Units
. Combination Machines	295,000 Units
. Revised Talking Book Machines	351,000 Units
. Revised Cassette Book Machines	18,000 Units
Recorded Products	
. Flexible Disc Magazines	12,810,000 Copies
. Flexible Disc Books	6,679,000 Copies
. Rigid Disc Books	550,000 Copies
. Cassette Books	2,400,000 Copies

FACTOR ANALYSIS (RELATIONSHIP TO OTHER PLANS)

Factor	Value for Five Year Period
Cost/Benefit Ratio	2.33 (least disbenefit to readers)
Total Number of New Titles	7,442 (equal to other plans)
Cost Effectiveness Ranking	
. Five Year Lowest Cost Program	$ 75,741,000
. Five Year Highest Cost Program	$104,259,000

AVERAGE FIVE YEAR
EQUAL BUDGET/UNEQUAL CAPABILITY PER READER
(Statistics Related to Programs Budgeted at $88,512,000)

Five Year Cost	$ 74.23 (Same)
Potential Utilization of New Equipment	.726 Units (Highest)
Potential Utilization of Recorded Product	18.82 Units (Highest)

7.2 The Plan of Action

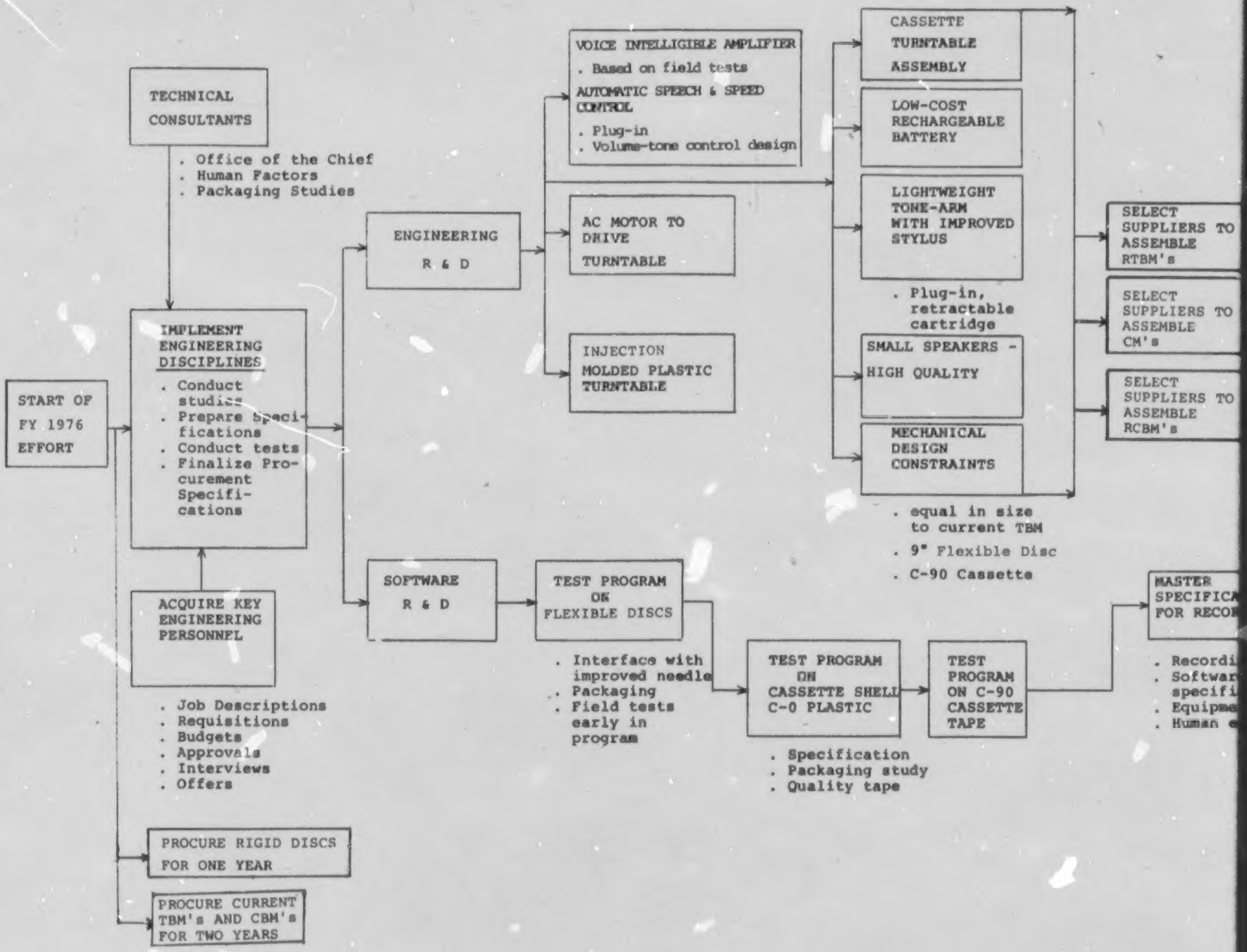
Any plan is a guide to the course of action for accomplishing program objectives and definitizes the milestones by which performance status and appraisals can be measured. As the detailed blueprint against which future progress is measured, it must incorporate the basic principles of effective management:

- The Objective - the conversion of recorded books and magazines to cassettes and flexible discs, to meet the needs of the future in providing reading materials to blind and physically handicapped readers at an increase in readers at a rate of 20% per year.
- The Planning - the organization of the effort and the process of determining the elements of work involved in meeting the objective. The presented flow chart (Figure 7.1) and implementation schedule (Figure 7.2) identify the recommended approach to accomplish the elements of effort defined for a five year period.
- The Staffing - the assignment of the responsibility and the function of deciding what each of the DBPH organizational activities will accomplish. These elements of program effort are shown in the "Organizational Action" program chart (Figure 7.3).

  This chart identifies the sensitive or critical areas that would have the most effect on meeting the target dates for the completion of the conversion. It also identifies actions which may affect the current DBPH policies, procedures, and internal facilitation. The preliminary budget model presented in Section 5 as Figure 5.7 incorporates all of these recommended actions.

7.3 Summary of Program - Recommended Actions

The detailed recommendations in the plan and the answers to the questions presented by DBPH in RFP 75-17 are provided in this summary.


TECHNICAL CONSULTANTS
. Office of the Chief
. Human Factors
. Packaging Studies
START OF FY 1976 EFFORT
IMPLEMENT ENGINEERING DISCIPLINES
. Conduct studies
. Prepare Specifications
. Conduct tests
. Finalize Procurement Specifications
ACQUIRE KEY ENGINEERING PERSONNEL
. Job Descriptions
. Requisitions
. Budgets
. Approvals
. Interviews
. Offers
PROCURE RIGID DISCS FOR ONE YEAR
PROCURE CURRENT TBM's AND CBM's FOR TWO YEARS
ENGINEERING R & D
VOICE INTELLIGIBLE AMPLIFIER
. Based on field tests
AUTOMATIC SPEECH & SPEED CONTROL
. Plug-in
. Volume-tone control design
AC MOTOR TO DRIVE TURNTABLE
INJECTION MOLDED PLASTIC TURNTABLE
CASSETTE TURNTABLE ASSEMBLY
LOW-COST RECHARGEABLE BATTERY
LIGHTWEIGHT TONE-ARM WITH IMPROVED STYLUS
. Plug-in, retractable cartridge
SMALL SPEAKERS - HIGH QUALITY
MECHANICAL DESIGN CONSTRAINTS
. equal in size to current TBM
. 9" Flexible Disc
. C-90 Cassette
SELECT SUPPLIERS TO ASSEMBLE RTBM's
SELECT SUPPLIERS TO ASSEMBLE CM's
SELECT SUPPLIERS TO ASSEMBLE RCBM's
SOFTWARE R & D
TEST PROGRAM ON FLEXIBLE DISCS
. Interface with improved needle
. Packaging
. Field tests early in program
TEST PROGRAM ON CASSETTE SHELL C-0 PLASTIC
. Specification
. Packaging study
. Quality tape
TEST PROGRAM ON C-90 CASSETTE TAPE
MASTER SPECIFICA FOR RECOR
. Recordi
. Softwar specifi
. Equipme
. Human e

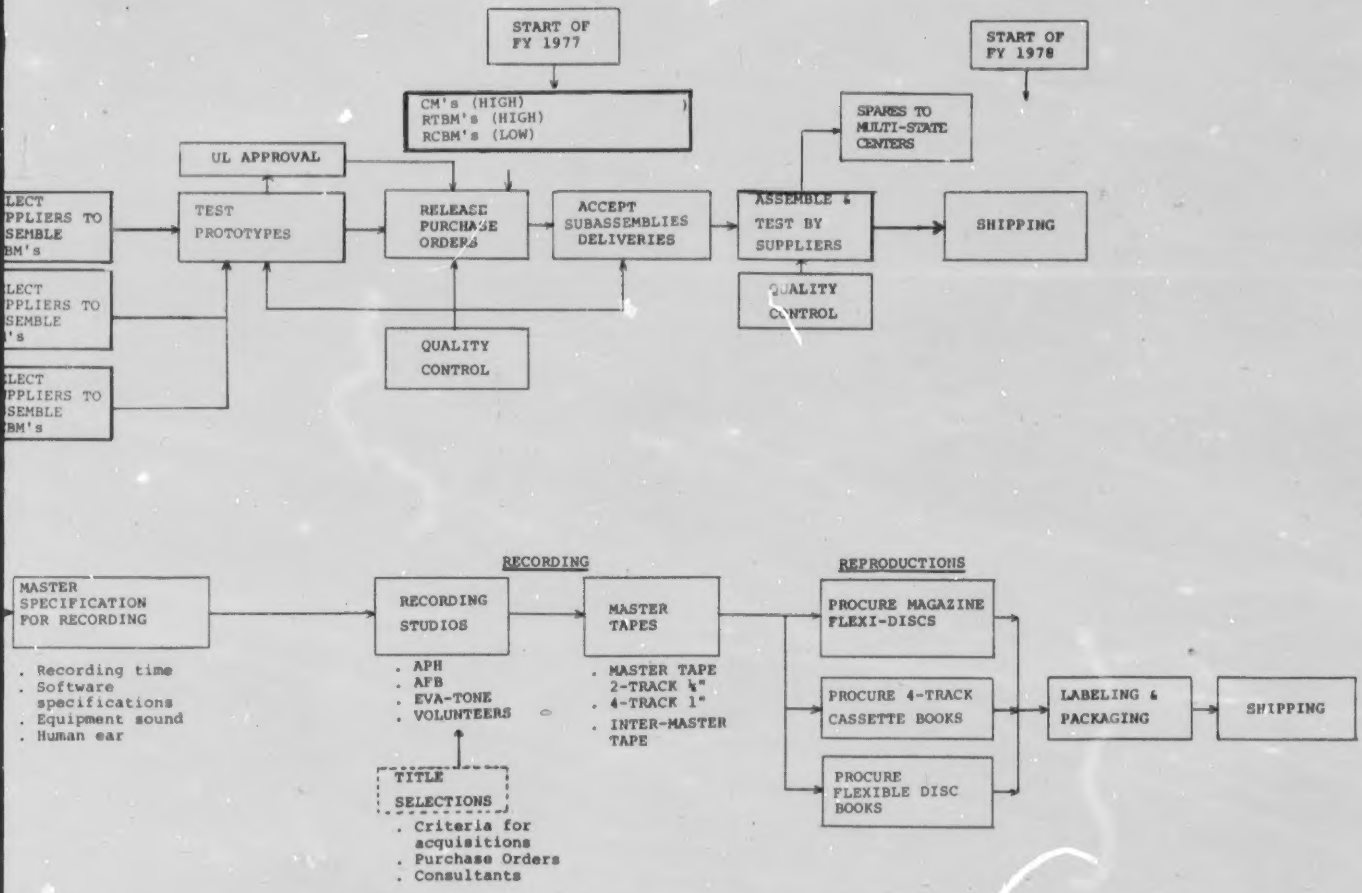
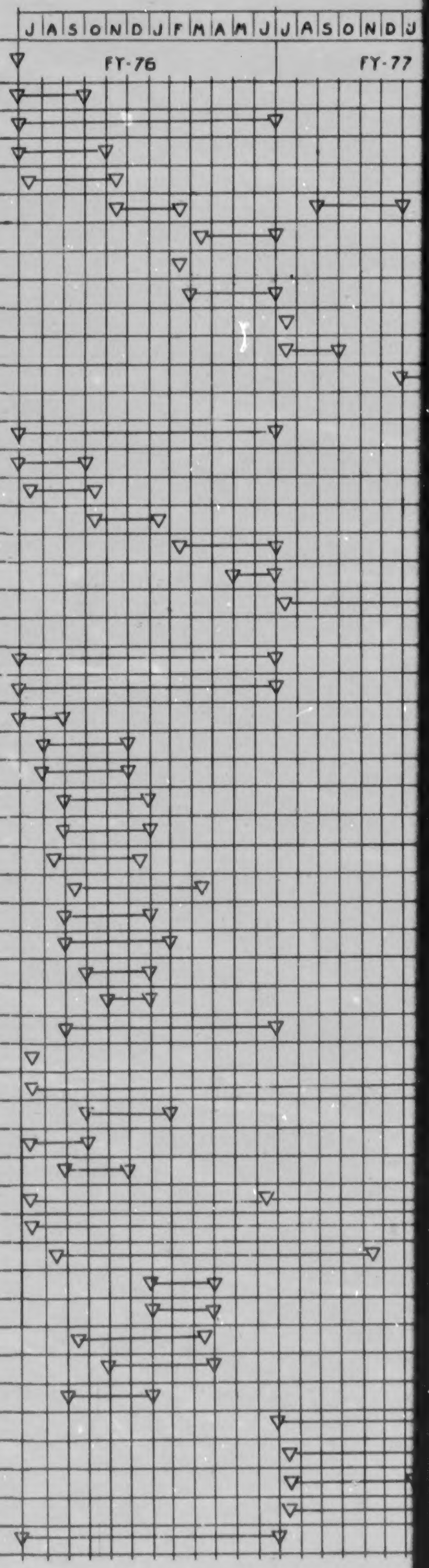

START OF FY 1977
CM's (HIGH)
RTBM's (HIGH)
RCBM's (LOW)
START OF FY 1978
SPARES TO MULTI-STATE CENTERS
UL APPROVAL
LECT PPLIERS TO SEMBLE BM's
TEST PROTOTYPES
RELEASE PURCHASE ORDERS
ACCEPT SUBASSEMBLIES DELIVERIES
ASSEMBLE & TEST BY SUPPLIERS
SHIPPING
LECT PPLIERS TO SEMBLE 'S
QUALITY CONTROL
QUALITY CONTROL
LECT PPLIERS TO SEMBLE BM's
RECORDING
REPRODUCTIONS
MASTER SPECIFICATION FOR RECORDING
. Recording time
. Software specifications
. Equipment sound
. Human ear
RECORDING STUDIOS
. APH
. AFB
. EVA-TONE
. VOLUNTEERS
TITLE SELECTIONS
. Criteria for acquisitions
. Purchase Orders
. Consultants
MASTER TAPES
. MASTER TAPE 2-TRACK ¼"
. 4-TRACK 1"
. INTER-MASTER TAPE
PROCURE MAGAZINE FLEXI-DISCS
PROCURE 4-TRACK CASSETTE BOOKS
PROCURE FLEXIBLE DISC BOOKS
LABELING & PACKAGING
SHIPPING

Figure 7.1
OPTIMUM PLAN ACTIVITY CHART

	PROGRAM GO-AHEAD
1.0	ACQUISITION OF KEY ENGINEERING PERSONNEL
2.0	ENGINEERING R&D - COMPATIBLE SUBASSEMBLIES
2.1	STUDIES AND FIELD TEST PROJECTS
2.2	PREPARATION OF PERFORMANCE SPECIFICATIONS
2.3	TEST PROGRAMS
2.4	PREPARATION OF PROCUREMENT SPECIFICATIONS
3.0	SELECTION OF EQUIPMENT ASSEMBLY SUPPLIERS
4.0	ASSEMBLE AND TEST PROTOTYPES
5.0	UL APPROVAL
6.0	RELEASE PURCHASE ORDERS
7.0	EQUIPMENT ASSEMBLY AND TEST
8.0	DELIVERY OF EQUIPMENT
9.0	SOFTWARE R&D
9.1	STUDIES AND FIELD TEST PROJECTS
9.2	PREPARATION OF PERFORMANCE SPECIFICATIONS
9.3	TEST PROGRAMS
9.4	PREPARATION OF PROCUREMENT SPECIFICATIONS
9.5	PREPARATION OF MASTER SPECIFICATION FOR RECORDING
10.0	RECORDING AND REPRODUCTION
11.0	FLEXIBLE DISCS/CASSETTES DELIVERIES
11.1	CONTINUE RIGID DISC PURCHASE
12.0	DBPH SOUND IMPROVEMENT PROGRAMS
12.1	SELECTION CRITERIA FOR ACQUISITIONS
12.2	BIBLIOGRAPHIC PROGRAM
12.3	USE OF SUBJECT FIELD SPECIALISTS
12.4	INFORMATION STORAGE AND RETRIEVAL SYSTEM
12.5	DATA FORM SYSTEM - REGIONAL LIBRARIES
12.6	AUTOMATED MAILING LIST
12.7	USE OF IBM - ATMS PROGRAM
12.8	MANAGEMENT INFORMATION SYSTEM
12.9	FINANCIAL MODELS
12.10	BENEFIT COST PROCEDURES
12.11	BID EVALUATION TOOLS
12.12	SPECIAL PROCUREMENT PROCEDURES
13.0	TECHNICAL CONSULTANT FOR THE OFFICE OF THE CHIEF
14.0	TECHNICAL IMPROVEMENTS
14.1	SPARES INCREASE
14.2	FIELD MALFUNCTION REPORTING SYSTEM
14.3	FIELD MALFUNCTION ANALYSIS SYSTEM
14.4	MULTI-STATE FIELD MALFUNCTION ORGANIZATIONS
14.5	VOLUNTEER SUPPORT PROGRAM
14.6	TECH SUPPORT TO VOLUNTEERS
14.7	INSURANCE POLICY CONCEPT
14.8	WARRANTY PROGRAMS
14.9	USE OF IBM-ATMS PROGRAM
14.10	STATISTICAL DATA SYSTEM
14.11	MANAGEMENT INFORMATION SYSTEM
15.0	PRODUCTION IMPROVEMENTS
15.1	APH - ASSEMBLY, TEST AND RECORDING
15.2	AFB - RECORDING
15.3	VOLUNTEER PRODUCTION
16.0	EQUIPMENT PHASE-OUT (10 YEAR OLD EQUIPMENT)



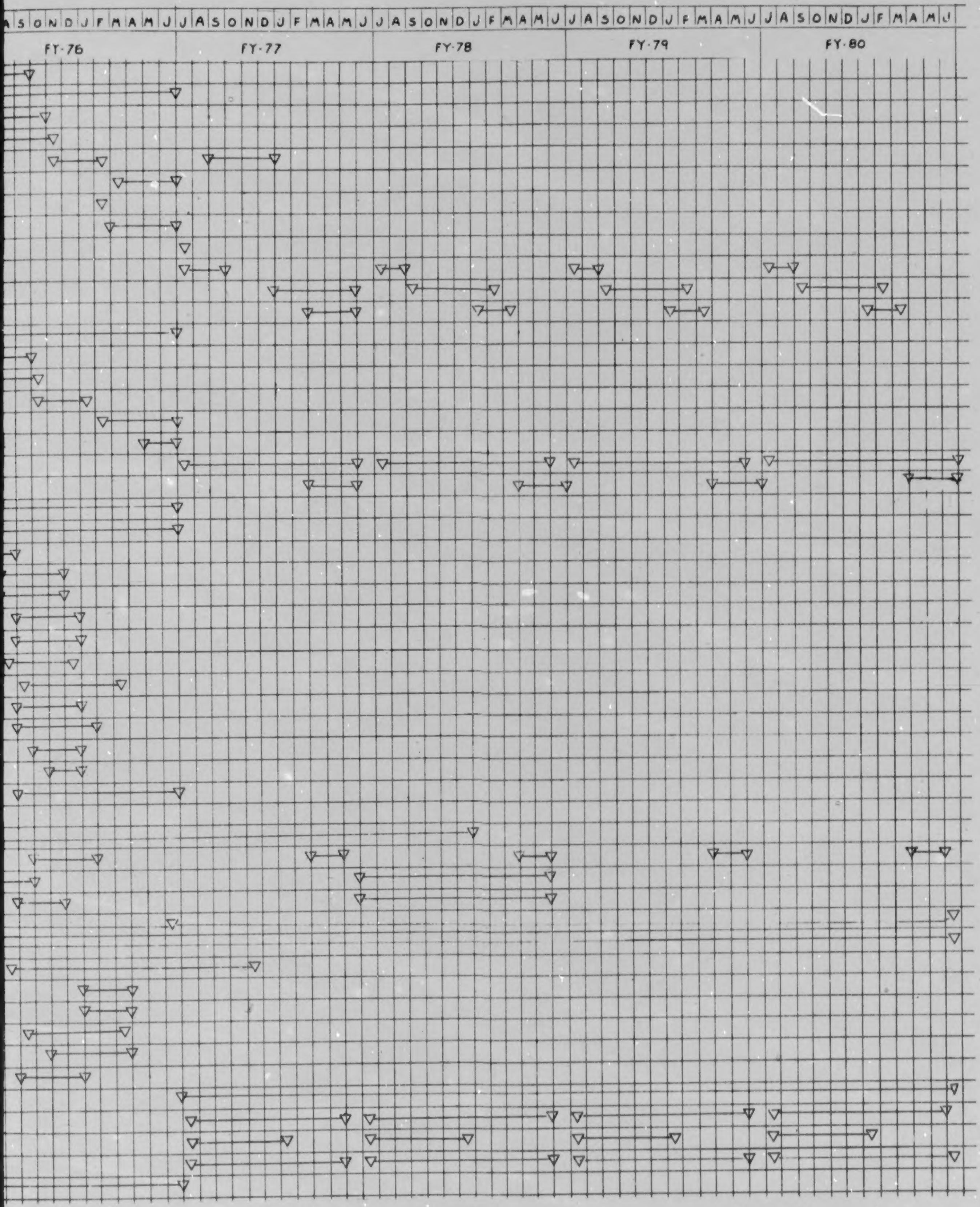
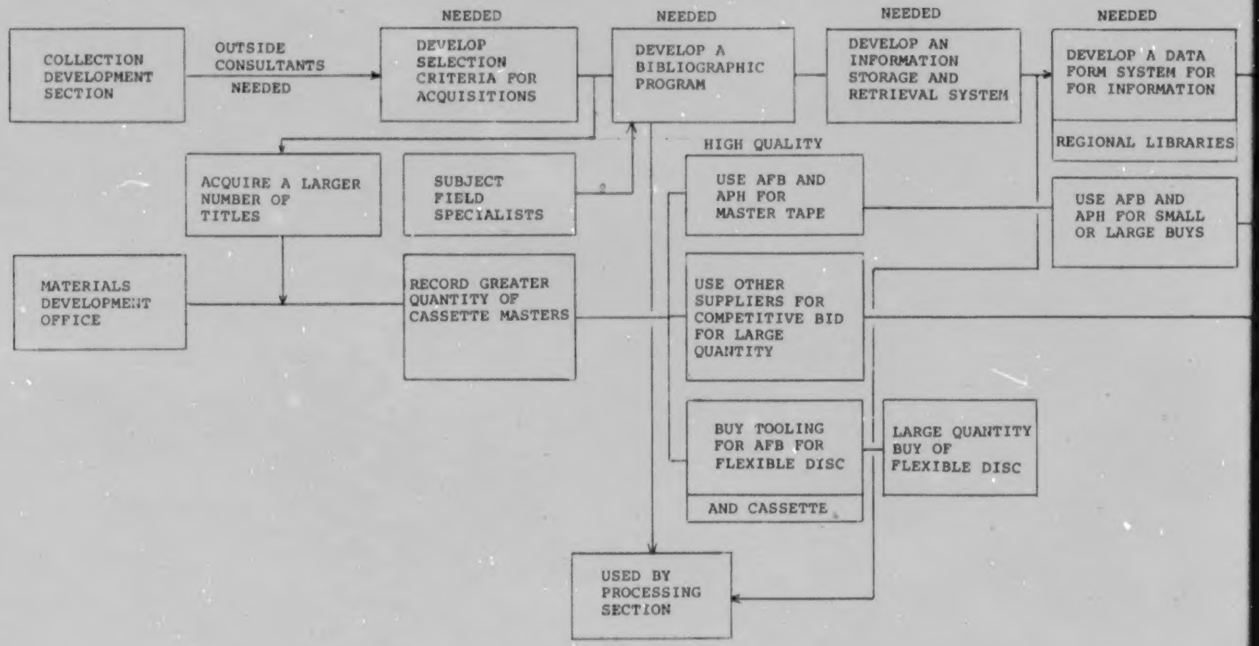
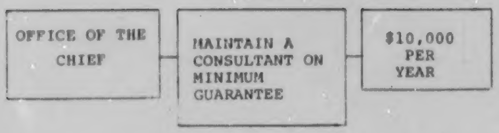
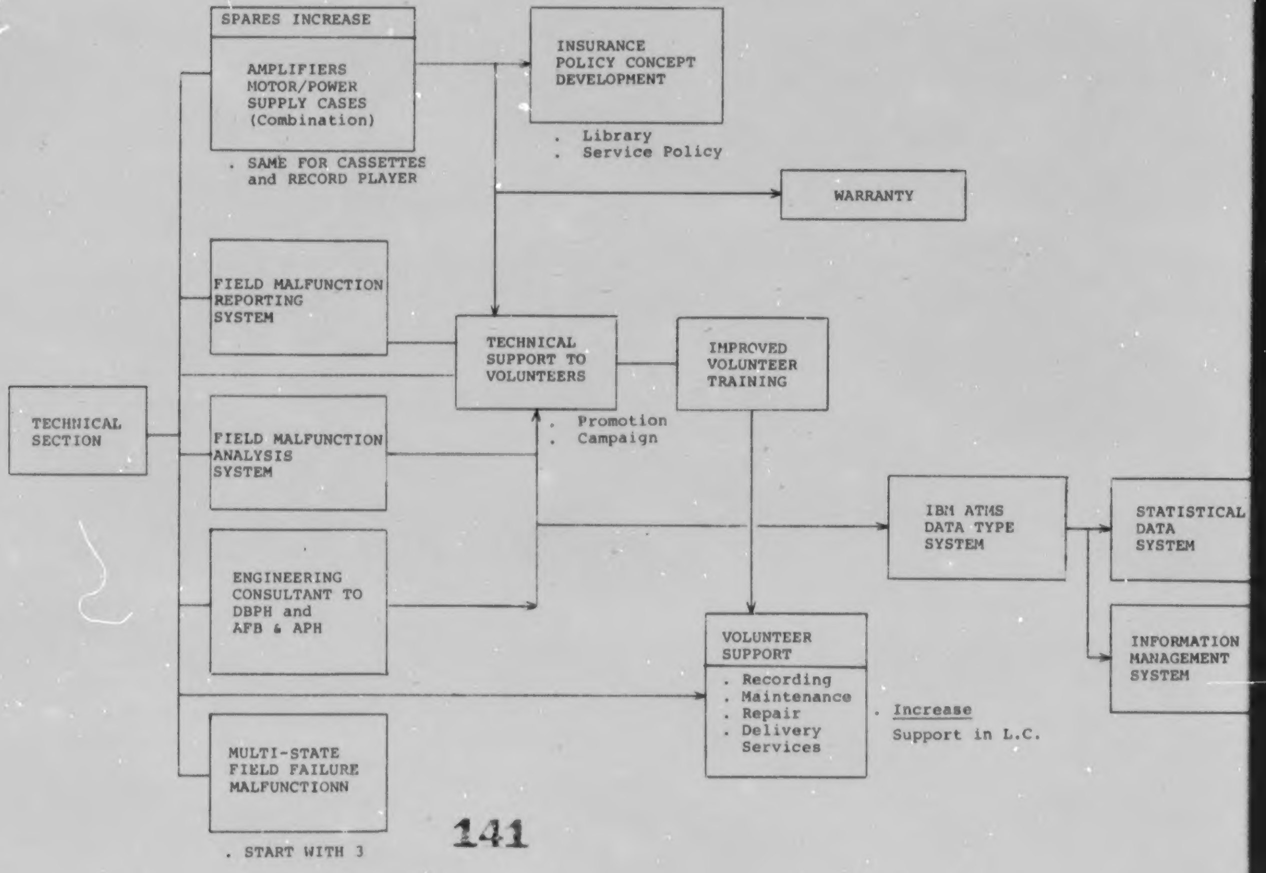


Figure 7.2

IMPLEMENTATION SCHEDULE


COLLECTION DEVELOPMENT SECTION
OUTSIDE CONSULTANTS NEEDED
NEEDED
DEVELOP SELECTION CRITERIA FOR ACQUISITIONS
NEEDED
DEVELOP A BIBLIOGRAPHIC PROGRAM
NEEDED
DEVELOP AN INFORMATION STORAGE AND RETRIEVAL SYSTEM
NEEDED
DEVELOP A DATA FORM SYSTEM FOR FOR INFORMATION
REGIONAL LIBRARIES
ACQUIRE A LARGER NUMBER OF TITLES
SUBJECT FIELD SPECIALISTS
HIGH QUALITY
USE AFB AND APH FOR MASTER TAPE
USE AFB AND APH FOR SMALL OR LARGE BUYS
MATERIALS DEVELOPMENT OFFICE
RECORD GREATER QUANTITY OF CASSETTE MASTERS
USE OTHER SUPPLIERS FOR COMPETITIVE BID FOR LARGE QUANTITY
BUY TOOLING FOR AFB FOR FLEXIBLE DISC
AND CASSETTE
LARGE QUANTITY BUY OF FLEXIBLE DISC
USED BY PROCESSING SECTION


OFFICE OF THE CHIEF
MAINTAIN A CONSULTANT ON MINIMUM GUARANTEE
$10,000 PER YEAR


SPARES INCREASE
AMPLIFIERS MOTOR/POWER SUPPLY CASES (Combination)
. SAME FOR CASSETTES and RECORD PLAYER
INSURANCE POLICY CONCEPT DEVELOPMENT
. Library
. Service Policy
WARRANTY
FIELD MALFUNCTION REPORTING SYSTEM
TECHNICAL SUPPORT TO VOLUNTEERS
IMPROVED VOLUNTEER TRAINING
TECHNICAL SECTION
FIELD MALFUNCTION ANALYSIS SYSTEM
. Promotion
. Campaign
IBM ATMS DATA TYPE SYSTEM
STATISTICAL DATA SYSTEM
ENGINEERING CONSULTANT TO DBPH and AFB & APH
INFORMATION MANAGEMENT SYSTEM
VOLUNTEER SUPPORT
. Recording
. Maintenance
. Repair
. Delivery Services
. Increase Support in L.C.
MULTI-STATE FIELD FAILURE MALFUNCTIONN
. START WITH 3

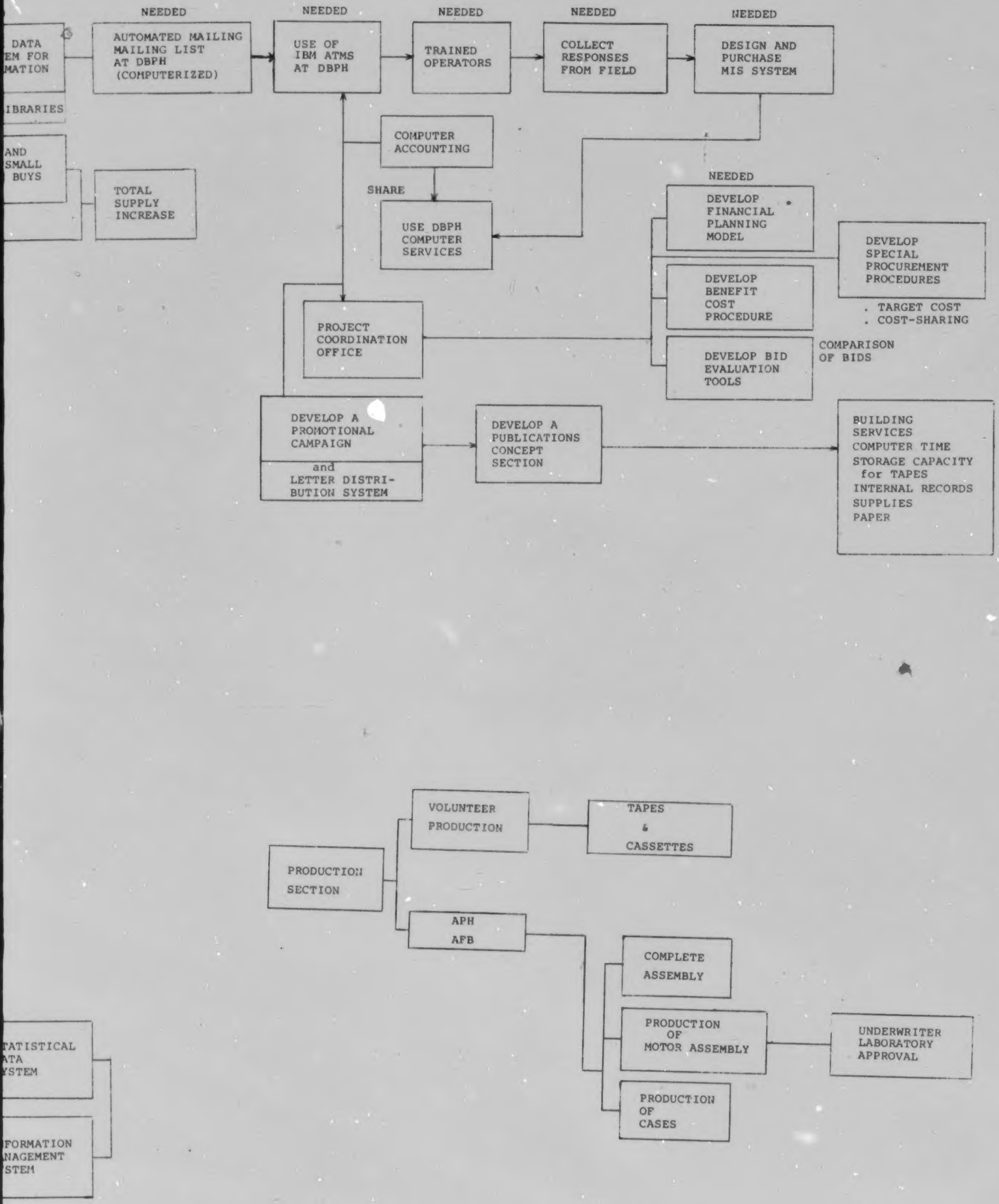

DATA
EM FOR
MATION
IBRARIES
AND
SMALL
BUYS
NEEDED
AUTOMATED MAILING
MAILING LIST
AT DBPH
(COMPUTERIZED)
NEEDED
USE OF
IBM ATMS
AT DBPH
NEEDED
TRAINED
OPERATORS
NEEDED
COLLECT
RESPONSES
FROM FIELD
NEEDED
DESIGN AND
PURCHASE
MIS SYSTEM
COMPUTER
ACCOUNTING
SHARE
USE DBPH
COMPUTER
SERVICES
TOTAL
SUPPLY
INCREASE
NEEDED
DEVELOP
FINANCIAL
PLANNING
MODEL
DEVELOP
SPECIAL
PROCUREMENT
PROCEDURES
. TARGET COST
. COST-SHARING
DEVELOP
BENEFIT
COST
PROCEDURE
PROJECT
COORDINATION
OFFICE
DEVELOP BID
EVALUATION
TOOLS
COMPARISON
OF BIDS
DEVELOP A
PROMOTIONAL
CAMPAIGN
and
LETTER DISTRIBUTION SYSTEM
DEVELOP A
PUBLICATIONS
CONCEPT
SECTION
BUILDING
SERVICES
COMPUTER TIME
STORAGE CAPACITY
for TAPES
INTERNAL RECORDS
SUPPLIES
PAPER
VOLUNTEER
PRODUCTION
TAPES
&
CASSETTES
PRODUCTION
SECTION
APH
AFB
COMPLETE
ASSEMBLY
PRODUCTION
OF
MOTOR ASSEMBLY
UNDERWRITER
LABORATORY
APPROVAL
PRODUCTION
OF
CASES
TATISTICAL
ATA
YSTEM
FORMATION
NAGEMENT
YSTEM

Figure 7.3

ORGANIZATIONAL ACTION RECOMMENDATIONS

1. During the five year conversion period starting with FY 1976 as the base year, and running through FY 1980, it is possible to maintain the ability for all eligible readers to continue to use the 33-1/3 rpm, and 16-2/3 rpm TBM's, 1-7/8 ips and 15/16 ips CBM's, and all compatible recorded materials.

2. In the future, new or replacement recorded editions of books selected for national distribution should be issued in both tape cassette and flexible disc formats. Recorded editions of popular magazines should be issued only on flexible discs. The flexible disc format may be the most desirable economical method for reproducing the most popular versions (high quantity) of books or magazines. Large specialized magazines that are not in popular demand should be issued in tape cassette format. The 8-1/3 rpm rigid disc program should be converted to the 8-1/3 rpm flexible disc program at the start of FY 1977, in order to allow for the transition and acceptance of the readers, who are acclimated to the use of the rigid disc. Cassette books should be procured in 4-track versions at a speed of 15/16 ips. Because of reader preference, both the flexible disc and the cassette books should remain for the next five years as the types of recorded editions, if the proper cassette shell and tape are specified.

3. The study confirms the assumption that the conversion to cassette books, flexible disc books and magazines can be accomplished smoothly in three to five years, using FY 1976 as the base year, if and only if the recommended actions take place. Assuming that the appropriate budget increases will be approved by the Library of Congress Administration and by Congress to assure the smooth conversion in the given time span, DBPH can expect the total number of readers participating in the national program to increase at an annual rate of 20% over the five years beginning with FY 1976.

4. It was not possible to ascertain the exact remaining life expectancy status of the equipment in the field in order to determine accurately whether 5% to 15% of the equipment in the field needs to be replaced. Since only one out of ten readers in hospitals or institutions have currently available equipment, it would seem logical that, if the equipment in the field which is over 10 years of age were still usable, additional equipment could be supplied to these readers and, therefore, increase the percentage of machines to readers.

5. The study reaffirmed the assumptions that the majority of the readers are over 60 years of age and are visually handicapped. Also, a significant minority have physical handicaps, other than blindness. This group prefers equipment and material that are relatively easy to use and occupy a small amount of space. It was also recognized that the younger age group and the better educated segment of the population would prefer portable equipment and that these groups comprise a a significant minority. If the program were to be promoted and new readers were attracted, DBPH can expect that the assumptions made previously would still apply.

6. The study did not indicate that during the conversion period DBPH will encounter unpredictable shortages of material and components which may delay obtaining machines or recorded material on time and therefore prevent the delivery to the readers on an improved schedule. This belief is based upon the evaluation of the current supplier's capacity to produce equipment and recorded editions. The recommended new technical approach lends itself to mass production assembly techniques which will attract new suppliers to support DBPH objectives. If the current procurement practices of DBPH are modified, they will be able to achieve their set forth goals.

7. Although the results of the DBPH conducted reader test were not available, it can be fairly well predicted that the readers will accept books played on 4-track cassettes and the equipment to accommodate these cassettes once they are trained to do so.

8. The investigation has definitely confirmed that significant economies of scale can be realized if DBPH optimizes the number of reproduced copies made for each title of a book or magazine recorded. This allows them to select the proper medium for the recorded edition, which offers them the best cost/volume ratio. Producing cassette books in quantity has not been found to be the optimum at this stage of the investigation and the reusability of cassettes on a systematic basis can only be answered by a more thorough investigation of the network (regional, subregional and volunteer organizations) interests. The study results affirm that the direct mailing of flexible disc magazines to readers is preferable to the use of traditional library loan circulation procedures, provided that packaging, labeling and mailing list update costs are significantly reduced. The use of direct circulation in the delivery of flexible disc books may also be desirable.

9. The study team investigated present technology and short-range and mid-range technological developments and concluded that there is no doubt that, if the entire program were properly administered and managed, the validity of present policies and plans could be successfully demonstrated.

10. The play-back equipment that DBPH should provide to insure the optimum cost/benefit and optimum reader benefit requires a distinctively different approach. The use of standardized compatible subassemblies requires an exhaustive specification, R&D effort, and test program to be conducted by DBPH. A change in its procurement practices by which large quantities can be procured continuously from established and qualified suppliers must be evaluated.

11. A combination phonograph/cassette machine with a compatible amplifier and speaker system with the phonograph turntable and associated controls and the cassette transport and associated controls all in one cabinet is recommended. This unit can be priced economically (less

than $75) and provides significant utility to readers who desire both types of equipment and recorded material. It also provides an excellent "hedge" on the uncertainty of future choices of selected recorded editions and an acceptable transition for readers unaccustomed to using the cassette machine.

12. Two stand-alone phonograph (RTBM) and cassette (RCBM) units using parts compatible to those contained within the combination (CM) phonograph/cassette machine are also recommended.

13. A significant amount of improvements in the design and physical packaging of the cassettes and flexible discs is needed.

14. As a result of all of the new technical requirements, it is strongly recommended that an improvement occur in the technical skills presently available in DBPH. The acquisition of a key individual with both broad-based technical and administrative skills would help establish the organization needed to meet the requirements of the conversion program.

15. At this point in time, DBPH should not envision a critical shortage of material, especially polyvinyl chloride. Current manufacturers feel that, because of its high price and limited use by a few record companies, preferential treatment by the one major supplier, Phillips Petroleum Products, will continue. If DBPH could guarantee larger future purchases, other raw stock suppliers (such as Dupont) might be attracted.

16. The future production of cassettes cannot achieve a cost/volume ratio equivalent to the flexible disc. A cost reduction can be achieved with large volume cassette production in quantities from 1000 to 2000; however, in quantities of 3000 and above the flexible disc is considerably cheaper. Flexible discs do cost less per disc as the production run increases. Good selection methods in the choice of titles and the number of copies provide the mechanism for deciding whether to produce a cassette book or a flexible disc book. Some recorded editions never achieve the popularity required to utilize mass volume production.

17. A complete review of specifications, test procedures, and equipment requirements is needed in order to provide a highly intelligible voice reproduction system. This requires a detailed R&D effort on methods of recording, the choice of cassette and flexible disc, and the type of equipment performance acceptable and desired by the reader.

18. A reader listening intelligibility survey is needed to obtain information on what is the "best recorded sound." In addition, a reader survey involving a human factors study is also necessary in order to optimize the design of the equipment.

19. The timely and continuous use of significantly high purchasing power will improve the quality of the equipment, reduce the requirements

for spares and maintenance, and hasten the solution of problems encountered in the program. The individual compatible subassemblies needed for the new CM, RTBM and the RCBM may include:

- battery
- speaker
- motor
- plug-in amplifier
- turntable-cassette subassembly

The purchase of mass quantities of compatible subassemblies will provide assembled equipment at significantly lower costs.

20. Additional funds will be required to maintain a large spare parts inventory at both DBPH and the multi-state centers. Spares of the major subassemblies will also have to be provisioned to supply the increasing number of volunteers. The use of volunteers to maintain, repair, and deliver the equipment will be encouraged and promoted as a result of the new equipment concept developed.

21. In order to meet the recorded material needs of the readers who will be able to obtain new equipment, additional funds are required to alleviate book and magazine shortages through the provision of additional titles and copies.

22. The network participation must be expanded by increasing the number of subregional libraries and by providing additional support at the libraries to assist in the maintenance and test of returned cassettes. The new flexible disc magazine will be considered a throw-away item; however, it is believed that a high quality flexible disc can provide numerous playings and be used on a loan basis in the system. It is also necessary to encourage the library network to increase its storage capabilities.

23. An increase in the dissemination and promotional efforts of the DBPH staff to inform the libraries of its increased service potential in both selected titles and available machines is needed.

24. Additional published materials will be needed such as catalogs, records, inquiry forms, catalog cards, cumulative book lists, and other bibliographic resources.

25. An improvement in the maintenance of the increased size of the mailing lists will also be required to handle the projected reader increase.

26. A new method of procurement of master tapes should be initiated. It is recommended that master tapes of a high quality nature be obtained from non-profit professional organizations and that they be required to maintain storage at their facilities. In the procurement procedure they will be asked to be capable of producing both a large

number of copies and a small number of copies in response to procurement requests made by DBPH staff. It can be assumed that a large quantity of both flexible disc and cassette reproduction can be made by obtaining competitive bids from non-profit and commercial suppliers, if provided with government owned master tapes. The original recorder of the master tapes will, upon request, supply the selected master tapes to the successful competitive bidder. Volunteer organizations should be encouraged to become master tape suppliers by being provided funds for the purchase of recording equipment to make high quality master tapes.

27. The new equipment must retire the obsolescent machines, some of which are more than 10 years old. A service life of five years has been recommended by GSA; however, the DBPH network should design all of their new equipment to have a service life of 10 years. The proposed plan provides for an average replacement of 5% of the equipment per year in order to conservatively allow for a rapidly increasing readership demand. This must actually happen and the older machines must be removed from inventory; otherwise, the malfunction rates of the equipment will cause readers to leave the program and, therefore, decrease the benefits provided.

28. The increase in administrative support required to handle the increase in readers can only be accomplished through the implementation of new DBPH procedures requiring automated systems. These systems will be usable by each of the organizations involved in the structure of DBPH. These new systems include the use of:

- an information storage and retrieval system which provides word-text processing
- a mechanized statistical recording system
- an on-line information management system
- a national bibliographic system

29. An information management system is recommended to support the entire Division and should include output report generators as follows:

- project planning and budgeting
- financial investment planning
- distribution planning
- inventory planning
- field failure analysis
- statistical analysis
- scatter diagrams
- bar graphs
- continuous curve plots
- histograms
- pattern recognition
- time-series analysis
- eligible user and possible eligible user statistical information
- selection criteria for title acquisition

30. A comprehensive study should be undertaken in developing the selection criteria and ranking and scoring systems for title acquisitions in order to insure that they meet the library system and reader needs. In 1974, more than 30,000 new English language titles were published in the United States. The funds appropriated permitted only 3% of these to be made available in recorded form for eligible users. As the target population increases DBPH needs to have a system that provides information on reader preferences. This will require the design of:

- questionnaires for regional and subregional libraries and for readers
- methods for modeling the responses including feedback mechanisms
- development of selection criteria based on ranking and scoring methods and the use of cross-impact analysis

31. A comprehensive research study must be undertaken of those who are clearly eligible for services, but who as yet are not readers. It will identify those handicapped groups most likely to become readers and establish the similarities and differences between their reading needs and those of the present readership to provide a base for systematic program planning.

32. A complete technical study performed by an engineering consultant should be contracted to include:

- Improved Quality Control Procedures
- Mean Time Between Failure Analysis (MTBF)
- Mean Time To Repair Analysis (MTTR)
- Advanced Technology Studies
- Revised Technical Specifications

33. It is recommended that a new cassette standard, replacing the Philips Standard, be developed and that DBPH test different cassettes and recommend the type to be used. This will provide a fair and reasonable approach for competitive bidding for the non-profit companies and assure high quality. It is believed that the cassette is the essence of the trouble in the field. A field test using C-90 tape cassettes should clear up the question of the reliability of the C-90 cassettes. It is also recommended that an exhaustive field test program of the flexible disc be conducted to ascertain that it can be recirculated for a minimum of 50 playings.

34. The design of "Cost/Benefit Procedures" and "Bid Evaluation Instruments" for future evaluation studies of planned procurements and budget submissions is recommended.

35. The development of a new training program which includes training in statistics, data processing and data analysis for the personnel on the DBPH staff is recommended.

36. The start of a nationwide promotional program to develop increased reader interest in the program is needed.

37. Increased training and technical support to the volunteers and the implementation of an increased volunteer recruitment program is recommended.

38. A detailed program description of the test evaluations made by the Underwriters' Testing Laboratory should be obtained.

39. Contracting for the services of subject field specialists should be provided in order to improve on the method of selecting new titles.

40. A reusable package should be designed to allow the users to return the equipment to the regional libraries.

41. When DBPH personnel retire or leave (normal attrition), there should be a change in the type of job classifications to accommodate the new skills needed to implement the optimum plan.

THE BACKGROUND DATA SUPPORTING THE ABOVE RECOMMENDATIONS IS INCLUDED IN THE PRECEDING SECTIONS OF THIS REPORT. THE OVERALL PROGRAM PROVIDES FOR:

- AN INCREASED READERSHIP
- AN INCREASE IN THE AVAILABLE EQUIPMENT AND RECORDED MATERIAL
- A SIGNIFICANT IMPROVEMENT IN BENEFITS TO THE READERSHIP

APPENDIX A

STUDY METHODOLOGY AND APPROACH

Figure A.1 is a flow chart which identifies the activities and the effort conducted during the two month contractural period.

Presented in this chart is the plan used for accomplishing the results required by the study. The approach to the study was subdivided into four distinct phases of activity:

Phase 1

A complete definition of the scope of effort, a proposal review and a reconfirmation of study objectives were obtained from the Contracting Officer, the DBPH Study Team Officer and other DBPH personnel. This phase ascertained:

- the availability of additional test or study data
- the sites to be visited and the schedules
- information on DBPH plans, procedures, organization, standards, assumptions and questions to be answered
- information on the regional and subregional library system

The study team reviewed and analyzed the new literature obtained and started the investigations of manufacturers and record producers providing talking books for the blind.

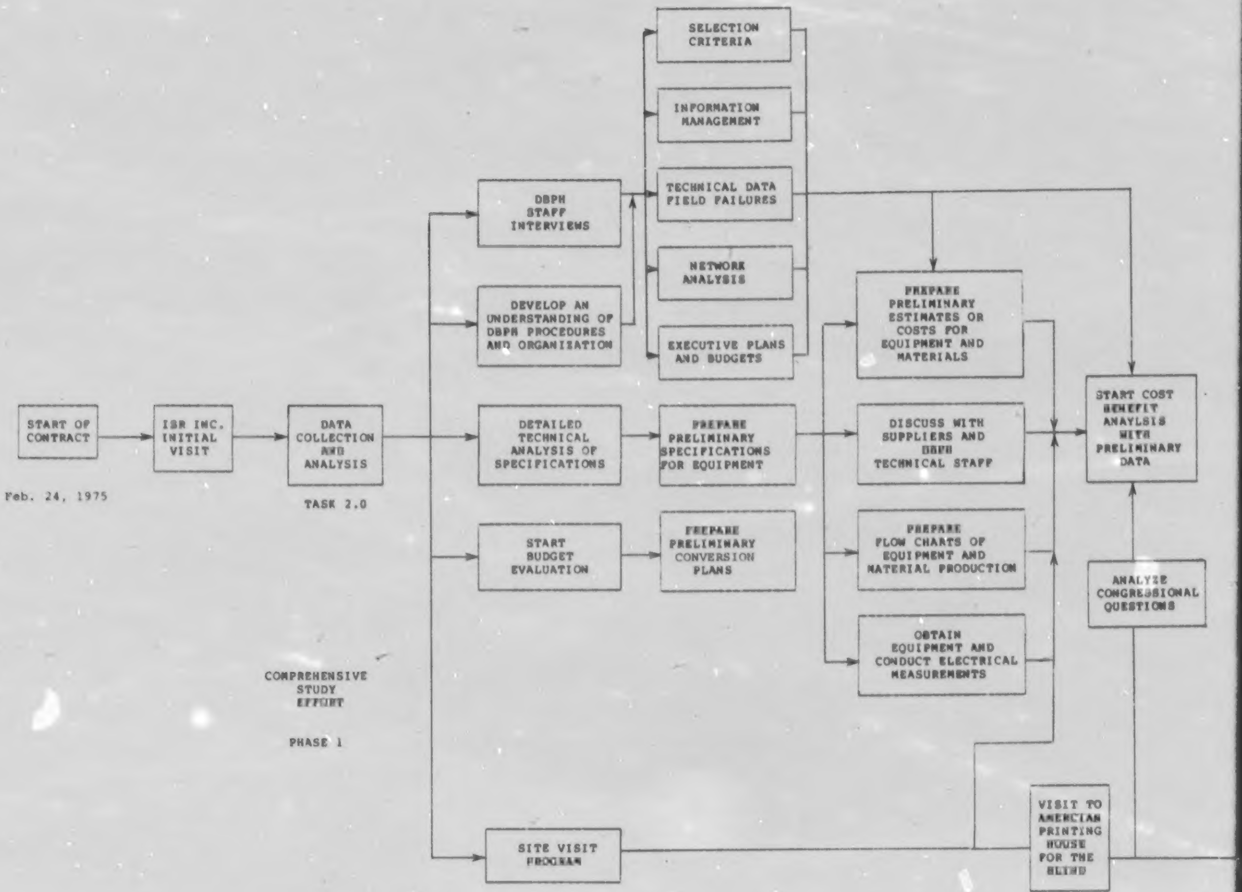
Phase 2

The detailed study effort involved an analysis of the:

- recorded editions
- recording and playback equipment
- advanced technology studies (short mid- and long-range)
- cost/volume ratio studies
- evaluation of current DBPH Audio Services Program
- reader preferences and eligibility criteria

This phase ended with the evaluation of twelve different plans and led to the selection of an optimum:

- five year conversion plan for materials
- the equipment conversion program - for five years
- the proposed program implementation budget


START OF CONTRACT
Feb. 24, 1975
ISR INC. INITIAL VISIT
DATA COLLECTION AND ANALYSIS
TASK 2.0
DBPH STAFF INTERVIEWS
DEVELOP AN UNDERSTANDING OF DBPH PROCEDURES AND ORGANIZATION
DETAILED TECHNICAL ANALYSIS OF SPECIFICATIONS
START BUDGET EVALUATION
SITE VISIT PROGRAM
SELECTION CRITERIA
INFORMATION MANAGEMENT
TECHNICAL DATA FIELD FAILURES
NETWORK ANALYSIS
EXECUTIVE PLANS AND BUDGETS
PREPARE PRELIMINARY SPECIFICATIONS FOR EQUIPMENT
PREPARE PRELIMINARY CONVERSION PLANS
PREPARE PRELIMINARY ESTIMATES OR COSTS FOR EQUIPMENT AND MATERIALS
DISCUSS WITH SUPPLIERS AND DBPH TECHNICAL STAFF
PREPARE FLOW CHARTS OF EQUIPMENT AND MATERIAL PRODUCTION
OBTAIN EQUIPMENT AND CONDUCT ELECTRICAL MEASUREMENTS
START COST BENEFIT ANAYLSIS WITH PRELIMINARY DATA
ANALYZE CONGRESSIONAL QUESTIONS
VISIT TO AMERCIAN PRINTING HOUSE FOR THE BLIND
COMPREHENSIVE STUDY EFFORT
PHASE 1

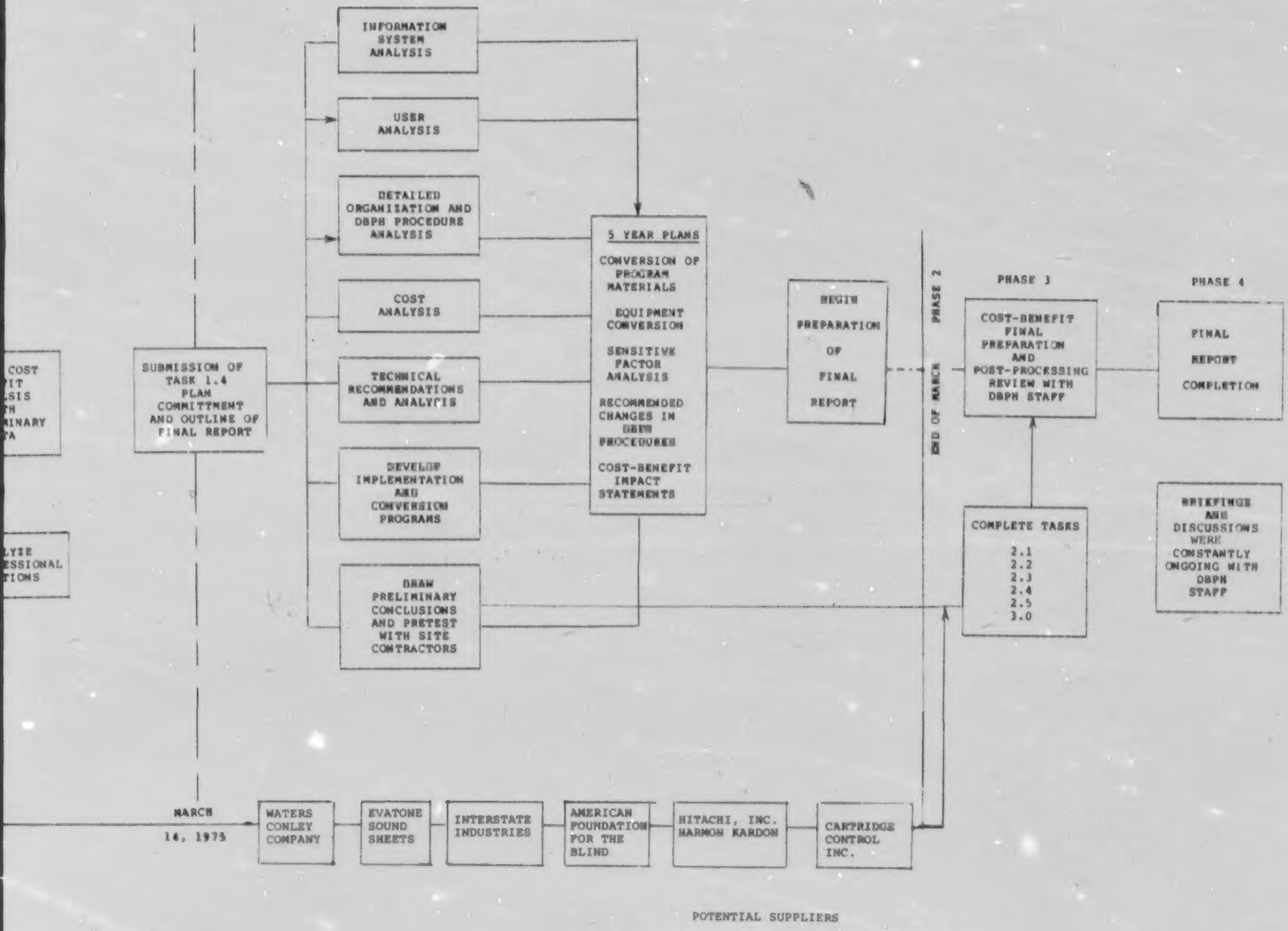

INFORMATION SYSTEM ANALYSIS
USER ANALYSIS
DETAILED ORGANIZATION AND DBPH PROCEDURE ANALYSIS
COST ANALYSIS
TECHNICAL RECOMMENDATIONS AND ANALYSIS
DEVELOP IMPLEMENTATION AND CONVERSION PROGRAMS
DRAW PRELIMINARY CONCLUSIONS AND PRETEST WITH SITE CONTRACTORS
COST
FIT
LSIS
TH
MINARY
TA
LYZE
ESSIONAL
TIONS
SUBMISSION OF TASK 1.4 PLAN COMMITTMENT AND OUTLINE OF FINAL REPORT
5 YEAR PLANS
CONVERSION OF PROGRAM MATERIALS
EQUIPMENT CONVERSION
SENSITIVE FACTOR ANALYSIS
RECOMMENDED CHANGES IN DBPH PROCEDURES
COST-BENEFIT IMPACT STATEMENTS
BEGIN PREPARATION OF FINAL REPORT
PHASE 2
END OF MARCH
PHASE 3
COST-BENEFIT FINAL PREPARATION AND POST-PROCESSING REVIEW WITH DBPH STAFF
PHASE 4
FINAL REPORT COMPLETION
COMPLETE TASKS
2.1
2.2
2.3
2.4
2.5
3.0
BRIEFINGS AND DISCUSSIONS WERE CONSTANTLY ONGOING WITH DBPH STAFF
MARCH
14, 1975
WATERS CONLEY COMPANY
EVATONE SOUND SHEETS
INTERSTATE INDUSTRIES
AMERICAN FOUNDATION FOR THE BLIND
HITACHI, INC. HARMON KARDON
CARTRIDGE CONTROL INC.
POTENTIAL SUPPLIERS

Figure A.1
APPROACH TO STUDY USED ON CONTRACT LC 1129

- the identification of sensitive or critical factors that would seriously cast doubt on the validity of DBPH policies and plans

- the recommendation of the changes in DBPH policies, procedures and internal equipment

- cost/benefit impact statement for the five year conversion period for the optimum plan

Phase 3

This involved the correlation of the data collected and analyzed during the study. It also includes the detailed analysis and the requisite intellectual post-processing with DBPH personnel that provided an indication of the sensitivity of the critical factors, the plausibility of the results and the completeness, relevancy and accuracy of the data collected.

All of this information was provided in the draft copy of the Final Report after a complete DBPH staff review. This draft was reviewed by the entire DBPH staff involved in the program and their comments were provided to the study contractor.

Phase 4

The Final Report was prepared with the specified revisions and submitted to the Contracting Officer.

APPENDIX B

EVALUATION OF DBPH READER CHARACTERISTICS

EVALUATION OF DBPH READER CHARACTERISTICS

B.1 Introduction

During fiscal year 1974, appropriated funds allowed only 3% of the 28,000 new English language titles (850 total), in addition to 35 magazines, to be made available to eligible readers. In order to make a determination of programs and materials needed and desired by the visually and physically handicapped served by the DBPH, particularly regarding the cassette book machine and flexible disc equipment, data from two major studies conducted in the past were reviewed. These are: 1) The Ohio Cassette Book Project - An Investigation of User Satisfaction by Genevieve M. Casey of the Wayne State University, published in 1973 and hereafter referred to as the OCBP, and 2) A Survey of Reader Characteristics Reading Interests and Equipment Preferences: A Study of Circulation Systems in Selected Regional Libraries by Nelson Associates Incorporated, published in response to a DBPH request in 1969 and hereafter referred to as the NAS.

Since a reader survey was not authorized, a review of the existing and furnished literature was necessary, even though the data may have been outdated. This literature was used to be able to: 1) review reader characteristics, title preferences and equipment preferences, and 2) to render recommendations on future title selection procedures based upon these foregoing studies and other relevant DBPH documents, in order that a selection policy may most efficiently mesh with the proposed conversion plans.

B.2 Reader Population Characteristics (Past)

Based on the two aforementioned studies alone, the following conclusions on reader characteristics of the past can be drawn:

- Age. The readership includes an extremely large proportion of aged readers as compared with the general population of the United States. The OCBP described 28% of their readers as over 65 years of age with a median age of 77; the NAS found that 43% of their readers fell into this category and that 69.1% were 45 years old or over.

- Educational Level. The readership includes a wide range of formal educational levels. Both studies found that approximately half of the total readerships had received at least high school diplomas (57.1% in the OCBP and 52.8% in the NAS.) Twenty-one percent of the Ohio respondents were college graduates (6% with post-baccalaureate degrees), whereas just under 30% attended or graduated from college. Of the NAS sample, 47.3% had less than a high school education. The 65 years old and over group had a slightly greater proportion of college graduates than the average for the total readership; however, the 25-34 age group contains the largest proportion of college graduates (83.1% of those in professional, managerial or technical jobs were college graduates). While under 13% of the total readership was employed, 26.7% of the college graduates were employed.

- Sex. Within the total readership, males and females were equally represented (OCBP: 56% F, 44% M; NAS: 53.8% F, 46.2% M) but both studies noted a substantially larger proportion of females in the oldest age class (over 65), also the age class with the largest number of readers (OCBP: 60% F, 40% M; NAS: 61.3% F, 38.7% M). No significant differences were found in special needs or in areas of interest for women as opposed to men.

- Occupation. The readership includes a wide range of occupation listings among those employed, but a disproportionate number of unemployed readers. The NAS reported 52.7% retired or unemployed, while the OCBP reported 27% unemployed - a significant difference, compared with the general population of the country. Students comprised 28.1% of the OCBP population and 14.5% of the NAS population; 28.1% of the OCBP readership consisted of housewives, as compared with 20.4% of their readers being employed; among these, the two most prevalent occupational fields were professional, managerial or technical (27.6%), and unskilled readers (70.4%) are between 35 and 64 years of age. Most students (92.8%) are under 25, most homemakers (90.4%) are over 35 years of age and most retired or unemployed readers (63.2%) are 65 and over.

- Residence. According to the OCBP, 88% of the readership lives within the community, either alone, with family or friends and 12% live in a residential school, hospital, nursing home or other institution. Similar data were reported by the NAS: 92.8% live within the community, 7.2% in institutions. Of those in institutions, most are over 65 years of age. Most readers living alone or in institutions are women.

- Handicap Classification. Visual handicaps alone represented the greater majority of readerships in both studies (OCBP: 75%; NAS: 71.5%). The remaining portions of both readerships consisted of such handicaps as quadriplegia, multiple sclerosis, cerebral palsy, stroke, arthritis and muscular and neurological disabilities. Of the NAS readership, 3.7% had physical handicaps alone; 28.5% were multiply handicapped, including visual handicaps. There was no significant difference in the number of males and females represented.

- Reading Volume. Readership volume ranged from between 1 and 32 books/month with 25% reading more than 6 books/month and 75% reading between 1 and 6 books/month (OCBP). No data were reported with respect to reading volume by the NAS.

- Geographic Distribution. Based upon 510 applications surveyed by the Reference and Information Section in 1973, the number of applications received from each state of the United States conformed roughly to each state's share of the general population with one notable exception - California; with 9.8% of the U.S. population, California had 31.3% of the applications for service.

- Age at which readers could no longer handle regular printed material. Both studies confirm that the largest percentage of readers began using special materials after 65 years of age. However, the majority of braille readers began use of special materials at a very early age (under 14).

- Purpose for using the DBPH service. Three out of four readers use the reading program for both entertainment and information, with the remainder being concerned only with the entertainment aspect. There appear to be no age, educational or occupational factors related to the purpose of use.

B.3 Reader Population Subject Preferences (In Previous Years)

With respect to readers' preferences for types of reading materials by subject, the NAS reports that four major subject matter categories were rated as very important and as types of material their readership would like to read more often. These include:

1.	General interest magazines (non-fiction)	63.9%
2.	Current events, news, popular culture (non-fiction)	57.4%
3.	Pleasant novels, family stories and light romances (fiction)	52.5%
4.	Best sellers (fiction)	51.7%

Relatively few types of fiction, other than types specifically listed in Table I, were requested by more than one reader via a written-in response. The three major types of fiction in this category were: 1) historical novels, 2) adventure stories and 3) animal stories. A number of types of non-fiction, other than types specifically listed in Table I, were requested by readers in the same fashion, but no single type was requested by more than a very small percentage of the respondents. The three major types of non-fiction in this category include: 1) travel, 2) medical science, diet and health and 3) autobiography.

In addition, the following relationships between subject preferences and other readership parameters were reported:

- Subject preference and format. Readers who have obtained materials on tape gave substantially higher ratings to several categories of materials - books which treat sex and violent action frankly, 19th and 20th Century authors, history, science, philosophy, instructional materials, essays and special interest magazines - than did the total readership. Much of the same relationship exists between formats which readers would like to borrow in the future and their reading interests.

- Subject preference and age. Readers in the youngest age group (1-14) give substantially lower ratings to general interest magazines, best sellers, 19th and 20th Century authors, philosophy and current events than does the total readership.

- Subject preference and sex. Men give higher ratings to science and to science fiction, mysteries and westerns than women do; women rate the pleasant novels, family stories and light romances higher than men do.

- Subject preference and educational level. Readers at the grade 1-4 level give substantially lower ratings to general magazines, best sellers, current events, 19th and 20thCentury authors and philosophy and substantially higher ratings to short stories, animal stories and religious materials than do most other readers. College graduates give substantially higher ratings than do other readers to 19th and 20th Century authors, biography and philosophy/psychology.

- Subject preference and occupation. Employed readers give higher ratings to books which give frank treatment to sex, violent actions or strong language, and to philosophy/psychology than most other readers do; students give higher ratings than other readers do to music, poetry and performing arts and to institutional materials; homemakers give a higher rating to pleasant novels, family stories and light romances than do other readers.

  Unskilled workers give lower ratings to general magazines and to current events than do most other readers. Skilled workers give higher ratings to science fiction, mysteries and westerns than do other readers. Farmers give higher ratings to animal stories and to Bible and religious reading and a lower rating to philosophy/psychology than other readers. Readers in the arts give higher ratings to biography and to science.

- Subject preference and satisfaction with the selection of materials available. Readers who express a preference for books which give frank treatment to sex, violent action or strong language give substantially lower ratings to the selection of books available than do most other readers. The same is true of readers who express a liking for animal stories, history, science fiction, mysteries and westerns who give somewhat higher ratings to the selection available than do most other readers.

The NAS readership was also asked to rate the selection of available materials through the DBPH service. For all formats, these ratings were as shown below:

- 48.3% rated the selection as very good
- 43.4% rated the selection as good
- 4.2% rated the selection as poor
- 4.1% had no opinion.

The following relationships between selection rating and other readerships parameters were reported:

- Available selection and the types of materials (formats) readers wish to borrow in the future. About one-half of the readers who indicate a desire to borrow talking book records in the future rate the selection "very good", but the service is rated "very good" by substantially less than one-half of the readers who indicate a desire to borrow tapes and tape cassettes.

- Available selection and age. Older readers rate the selection as "very good" more often than younger readers. In the 65+ age group, the selection is rated "very good" by 54.1%, as opposed to 35.2% of the 25-34 age group, who rate the selection "very good".

- Available selection and handicap classification. Readers with multiple handicaps display a greater tendency to rate the selection "very good" than do other groups.

- Available selection and age at which readers become unable to use regular printed materials. Readers who become unable to use regular printed materials later in life display a greater tendency to rate the selection "very good" than do readers who become unable to use regular printed materials earlier in life.

- Available selection and occupation. Smaller proportions of employed readers and of students rate the selection "very good" than was the case among homemakers, retired or unemployed readers.

- Available selection and kinds of equipment to which readers have access. Smaller proportions of readers who have access to tape recorders or tape cassette players rate the selection "very good" than do those readers among other groups.

A range of titles for the cassette book program was originally selected in 1968 by the DBPH on the basis of wide reading interests for the active handicapped reader, although the needs of college students, veterans, children and the elderly were not given special consideration until later.

Surveys concerning subject materials preferred by the OCBP readership survey related specifically to those readers who use cassettes already. The four most popular categories reported by the OCBP were as follows:

1.	Best selling fiction	56.3%
2.	Current periodicals (non-fiction)	46.1%
3.	Mystery stories	42.5%
4.	History (non-fiction)	36.5%

The OCBP also asked its readership to rate the adequacy for their needs and interests of the materials available on cassette. One hundred and sixty-one readers responded and their ratings were as follows:

- 17% rated the selection as excellent.
- 47% rated the selection as adequate.
- 35% rated the selection as less than satisfactory.

The OCBP qualifies their "adequate" ratings by stating that many of the readers who found the selection satisfactory observed that cassettes do not offer nearly the variety of subject matter that discs do; also that the selection is improving, but that they hope that it will continue to increase in the future.

Of the 35% of the OCBP readership that found the selection less than satisfactory, the following characteristics were reported:

- Those of a higher educational level tended to be most dissatisfied.
- The blind or visually handicapped readers showed a slightly higher ratio of dissatisfaction, compared to other readers with other types of handicaps.
- Those readers who showed dissatisfaction tended to have used talking books for a longer period of time and tended to be better read and more discriminating in their literary choices.
- Dissatisfied readers tended to be slightly more voluminous readers.

Specific titles and types of magazines were also requested by the readerships of both studies. Among the types of magazines most frequently requested were news magazines, women's magazines, children's magazines and the true romance - true story genre.

Few foreign languages were listed by respondents as languages in which the DBPH should provide books. Among the languages which were mentioned, the demand seems greatest for Spanish, French and German, in that order.

B.4 Reader Equipment Preferences (In Previous Years)

- Types of formats readers have borrowed in the past. Of the 167 readers in the OCBP, 158 had been using talking books within a range from less than 1 year to 39 years and were considered well qualified to compare books recorded on cassette tape with talking books on disc.

  Of the NAS readership, 98.4% had used talking books in the past. About 12% of all readers had obtained tapes in the past, but 25.7% expressed interest in borrowing tapes in the future. In addition, it appears that employed readers and students obtain tapes at a higher rate than homemakers, the unemployed, or retired readers.

- Types of formats readers would like to borrow in the future. The NAS reported the following:

Talking books on records	93.8%
Talking books on tape cassettes	11.5%
Other formats	52.4%

In addition, the following relationships between desired formats in the future and other readership parameters were reported:

- Future format desire and equipment preference. 78.5% of the readers who indicated a desire to borrow talking books in the future also indicated that they prefer a talking book machine to any other type of machine. Among readers who indicated a desire to borrow tape cassettes, more than half (51.3%) indicated a preference for the cassette player over any other type of machine.

- Future format desire and access to equipment. Among readers who expressed a desire to borrow tape cassettes, 22.7% now have access to such a machine, as opposed to 3.3% of readers who expressed a desire to borrow talking books.

- Future format desire and age. The oldest readers (65+ years of age - the largest single age group), show little interest in borrowing materials other than talking books on records. Tape cassettes find the greatest acceptance among readers above the age of 14, but under age 55.

- Future format desire and educational level. Tape cassettes find the greatest acceptance among more highly educated readers.

- Future format desire and occupation. Tape cassettes find the acceptance among students and employed readers.

- Future format desire and geographic distribution. The proportion of readers indicating a desire to borrow tape cassettes ranges from 23.2% of readers in one state to 3.4% of readers in another. The overwhelming majority of readers in every state indicates a desire to borrow talking books (records) in the future.

- Readers' preferences for equipment. The NAS reported the following readership equipment preferences:

. Talking book machine (records)	76.5%
. Tape cassette player	10.3%
. Other equipment	13.2%

In addition, the following relationships between equipment preferences and other readership preferences were reported:

- Equipment preference and access to equipment. About one-half (48.0%) of readers who have access to a tape cassette machine prefer it to any other type of machine.

- Equipment preference and playing time preferences (one side). Readers who prefer the conventional talking book machines show less preference for the longer playing times (beyond one-half hour) than do other readers, while readers who prefer tape cassette machines show more preference for the longer playing times than do other readers.

- Equipment preference and age. Greater acceptance is shown by younger readers of tape cassette players and older readers show stronger preference for the talking book machine. Of readers aged 65 or over (the largest single age group), 91.3% prefer the talking book machine, as opposed to 51.3% of readers in the 25-34 age group. Greatest preference for the cassette player was shown by the 35-44 age group (23.0%).

- Equipment preference and educational level. Those readers in the more highly educated groups show weaker preference for the talking book machine and stronger preference for tape cassette players than do the readers in the less highly educated groups.

- Equipment preference and occupation. Employed readers and students both show a substantially lower rate of preference for the talking book machine than do homemakers, retired or unemployed readers. Tape cassette players achieve the greatest acceptance among employed readers.

The OCBP asked 151 readers in which form they would prefer to read, given an equal range of equipment. Cassette books were rated first by 83% of the readers; talking books (discs) were rated first by 15% and 2% preferred other equipment.

- Opinions of readers on cassettes - OCBP. When questioned concerning the clarity of the tape which accompanies each cassette player from the DBPH, 90% of the respondents found the tape to be clear. The majority of readers who found it to be unclear were found to have special physical problems, or were extremely aged.

Concerning the use of cassettes, 132 readers agreed to participate in comparing the cassette equipment with talking books on discs. The cassettes were found easier to use - or about the same as books on discs - by 90% of the readers. Of the remaining 10%, 69% were over 65 years of age and had used talking books from three months to thirty years. The remainder were using cassettes for the first time.

As compared to talking books, 144 of 157 or 91% of the readers found the sound fidelity of cassettes as good, or better than, talking books.

Of the 167 readers, 128 compared the durability of the cassettes with talking books on discs: 39% judged talking books to be sturdier, 34% found the two to be about the same and 28% felt that talking books were the least durable.

When maintenance problems arose, they were most likely to lie in the cassette tape, rather than in the player. A recommendation was made by the OCBP that improving the durability of the cassette should be a major goal in the cassette program.

In comparison to other equipment, such as the talking book disc equipment, the respondents were asked to rate the value of compactness in the use of cassettes and 158 of them responded, rating as follows:

- 49% found compactness very important
- 18% found compactness important
- 20% found compactness of minor importance
- 11% found compactness of no significance

In summary, 67% of the readers held cassette tape compactness to be important.

- Advantages and disadvantages of cassette books - OCBP. Responses to questions of "What do you like best and least about books on cassette tape?" fell into a variety of areas. A summary of those responses follows:

Advantages. Ease of operation, compactness and portability were the major advantages as seen by the readers. Other advantages mentioned were:

- Lighter weight
- Portability and enhanced reading volume
- Battery usage permitted outdoor, car, bus or bed reading
- Smaller size is excellent when limited space is available
- Ease in mailing
- Ease in rewinding and re-listening
- Ease in changing from tape to tape
- Ease in marking the reader's place
- Ease in resuming reading
- Rapid rewind
- No skipping
- Capacity for changing speeds
- Earphones permitted additional privacy
- Sound fidelity (appreciated most by 11.3% of the respondents)

Disadvantages. The tapes, rather than the players, were the subject of numerous complaints. Other complaints concerned the inadequacy of available subject materials. Specifically, disadvantages mentioned were:

- Tendency for tapes to break
- Tendency for tapes to spin off
- Tendency for tapes to come out of the cartridge
- Tendency for tapes to twist
- Tendency for tapes to come loose at one end
- Tendency for tapes to come off at the end
- Difficulty in rewinding

    - Containers are unduly bulky
    - Difficulty exists in activating controls
    - The positioning of controls (side vs. top) is awkward

- Access to equipment. According to the NAS, 92.9% of the participating readers had access to a government owned talking book machine and 42.9% of the readers had access to a privately owned record player. Only 4.2% of the readers have access to a privately owned tape cassette player. Of the government owned talking book machines, two model numbers (AE3 and AE4) were held by substantially larger numbers of readers than any others. Most machines in use (88.2%) operate at 8-1/3 rpm.

B.5 Reader Library Service Attitudes (In Previous Years)

A startling fact uncovered in the NAS is that 94.4% of the respondents indicated that they did not know the location of their regional library. Slightly more than half of the readers (51.4%) learned of this special library service through a friend or relative, and 43.2% from a school, hospital or other institution.

Of those readers who received DBPH publications, 89.2% received Talking Book Topics. Catalogs of books available through the DBPH were received by 63.2% of the NAS readership. Of the total readership, 70.4% used the order form in Talking Book Topics to communicate their requests; 44.1% communicated requests by letter and 18.6% by telephone. Of those making requests, 86.6% felt that they usually received the books requested.

The respondents in the NAS were asked their opinions of the service that they receive at their regional library aside from their opinions concerning selection of materials or equipment. Well over one-half (61.9%) of all readers rated the service "very good". According to age group, 67.7% of the 65 years of age and over group and 50.4% of the 25-34 age group gave ratings of "very good". Readers with multiple handicaps and of higher educational levels gave generally higher ratings than other groups. The employed readers generally gave the service lower ratings.

In comparing ratings of selection and service, it was found that among those readers who felt that selection was "very good", 87.7% also felt that the service was "very good". For readers who rated the selection as "good", only 40.5% felt that the service was "very good". About one quarter of the readers who thought the selection was "poor" rated the service as "very good".

B.6 Reader Suggestions

Both studies arranged in some way for their readers to express themselves in response to topics not covered in either questionnaire. Readers responded in a wide variety of areas, including suggestions for improving the equipment, the selection of materials available and the library services in general. Many of the readers' responses dealt with requests for more services: more titles, more machines, more library staff members. In the execution of the proposed conversion program, it is felt that it would be most worthwhile for the DBPH to carefully review those suggestions included in the NAS and the OCBP. An interesting point for consideration is that despite the fact that these studies were conducted years ago, many of those reader suggestions that could lead to a definite improvement of service could still be implemented. If reader dissatisfaction or "disbenefit" is to decrease substantially in the years to come, it seems only reasonable that their complaints and suggestions should be carefully reviewed and implemented where it is both practical and possible.

B.7 Present Selection Policy for Reading Materials (1975)

The DBPH's readership represents a cross section of the American people, with similar reading needs and tastes. This readership should have access to the same books and information made available to the non-handicapped. The general reading needs of the aged, the young, the professionals and others should be reflected proportionately in the collection in relation to the overall readership served.

Complete texts in various subject fields are not usually published commercially in media usable by blind and physically handicapped individuals, hence the DBPH's readership is denied the alternative sources for obtaining printed information readily available to others.

As the major source of many otherwise unavailable materials, the DBPH's guidelines for selection are designed and interpreted to provide a collection broader in range than found in most public libraries. The DBPH undertakes to meet the diverse reading needs of as many of its readership as possible.

While aware of the need to offer a basic collection of standard classic and informational titles, the DBPH recognizes that works of popular interest and recreational purpose must be provided. Items selected after deliberation are reproduced in their entirety and remain in the collection, even if they prove offensive or unacceptable to some readers.

- Selection Guidelines

  A list of selection guidelines, dated August 13, 1974, from the Collection Development Section of the DBPH, follows:

  - Books are considered for selection only when print copies are available for examination.

  - Priority is given in the collection's development to making existing published material available. Original manuscripts are rarely accepted for the collection.

- The collection will contain the classics in all subject areas and in all kinds of literatures, as well as the best of the contemporary offerings in those subject areas and literatures, including anthologies and other collections. Emphasis is on production of complete works. The DBPH will not attempt to provide textbooks or other curriculum-related materials, except as such materials also serve the general public, nor will it include local histories or other items of specific local interest, or informational resources when the information contained therein is of a nature to become quickly out of date.

- It is expected that regional and subregional libraries will develop their own collections of local interest and develop their service programs in such a way as to meet informational needs for materials not provided by the DBPH. It is further expected that those volunteers and agencies working outside the network will be willing to meet the demands of readers for materials not provided by the network.

- The DBPH will purchase commercially produced works in recorded or embossed format only when they are reproductions of print books and only when it is more expeditious to do so. Non-print materials may be considered on an individual basis with approval for inclusion being granted by the Chief. Generally, the responsibility for procuring commercially produced recorded or embossed versions of print books, as well as supplementary non-book commercial works, rests with the regional and subregional libraries making up the DBPH's network.

- The DBPH seeks to stimulate governmental and other agencies to provide important documents, forms and explanatory information, necessary to the well-being of all citizens, in appropriate media for distribution. When an agency cannot or does not provide these items, the DBPH may attempt to do so.

- In order to incorporate as many titles as possible into the collection, titles are not reproduced in more than one recorded medium. Duplication in both braille and recorded media is minimal, as is the reproduction of previously produced titles in newly developed media.

- The DBPH provides periodicals in all media. Emphasis is on, but is not limited to, periodicals listed in the Reader's Guide to Periodical Literature to provide easy access to the periodicals for reference purposes.

- The young adult collection, serving students in grades nine to twelve, is considered a part of the adult collection, and selection of materials is governed by the same criteria and developed in the same way.

- The children's collection is developed to meet the needs of the children from preschool to eighth grade. The criteria used and the collection's development are patterned after the adult policy.

- Selection Criteria

  The DBPH has delineated the criteria for selecting titles for mass and limited distribution as it presently exists (March, 1975). This draft states that the following factors must be considered in reviewing titles for inclusion in the nationwide collection:

  - Will the title interest the reader?

    - Does the material meet the reader's information or recreational needs?

    - Does the material respond not only to his current reading needs but does selection anticipate his future needs?

    - Selection should seek to add titles which will interest not only the present community of readers but attract NEW readers to the program.

    - Selection staff must be flexible and keep abreast of current patterns in reading of adult public library patrons, e.g., books on occult, current topics in the news, revival of interest in science fiction, charismatic movement, etc.

  - General criteria for selecting titles for mass or limited production

MASS	LIMITED
Broadly based appeal to many readers throughout the United States	Appeals to a limited number of readers
Fills a major gap in the core collection made available to libraries	Enriches the collection on a given subject
Generally attempts to keep (60% - 40%) a balanced selection in the non-fiction and fiction categories	Fills a gap in a given subject area

  - Is the material available from other sources?

    - Textbooks or supplementary college reading from AFB or APH

    - Available commercially in recorded or braille (APH) form? (e.g., broadway musicals, songs, radio programs, learning a language.)

- Is the title one for which there will be heavy reader demand whether it has "value" or not?
    - Although the quality of the book is seriously considered, reader demand for a title or a subject may take precedence over value because of the kinds of readers served. (Many depend totally on DBPH as their sole source for reading.)

- Specific criteria for selecting titles
    - Non-fiction
        - Literary merit
        - Presentation
        - Popularity
        - Technicality
        - Scholarly nature
        - Is the subject represented in the collection? In which media?
        - Is this the best or one of the better books on the subject? How does the book compare with other books on the subject?
        - Is it well reviewed? Where? Do reviews agree or disagree?
        - Is it listed in widely acceptable bibliographical tools? (e.g., in Public Library Catalog, Children's Catalog, etc.)
        - Was it recommended by a reader?
        - Was it recommended by a librarian?
        - Is it a best seller type? Has it received wide publicity?
        - Does the format of the book preclude its being recorded or transcribed into braille? (e.g., depends on illustrations, detailed index, World Almanac; can it be

practicably produced (cost factor, work involved in indexing).

- To what audience will the title appeal (adults, young adults, older readers, men, students, professionals, etc.)? At what reading level?
- Reputation of the author? Reputation of the editor?
- Reputation of the publisher (Vanity Press Books not selected)?
- Is the material of general or local interest?
- Is it factual, authoritative?
- If a "new edition", does it differ substantially from the older edition?
- Does it have a partisan point of view? Does it proselytize?
- Is the arrangement of the book such that it makes the information more readily accessible to the reader (appendices, footnotes, bibliographies, graphs, addresses, etc.)?
- Does it add worthwhile information on the subject?
- Is it ephemeral? Will it date soon?
- Might the book be a potential hazard to readers (far out, fad diet, quacky medical information)?
- Is the treatment concrete or abstract?
- Is it exhaustive on subject, balanced in approach? Cursory?
- Is the title part of a multi-volume set?
- Is the information more accessible and up to date in magazine form?
- Will it require a special narrator (language ability)?
- Difficult subject (assigning book to a studio)?
- Can it be used by children to supplement textbooks? (APH)

- Fiction
  - To what audience will the title appeal (adults, young adults, older readers, men, women, students, specialists, etc.)?
  - Literary merit?
  - Does it contain graphic descriptions of sex? Violence? Strong language?
  - What type of work is it (romantic, symbolic, psychological, humorous, etc.)?
  - If it is a popular genre (mystery, western, science fiction, etc.), how many books have been added in this area?
  - Is it sensational, exaggerated, distorted?
  - Is the plot simple, original, complicated, improbable, etc.?
  - Does it sustain the reader's interest?
  - Does it inspire, amuse, provoke, satisfy, etc.?
  - Is it well reviewed?
  - Was it recommended by a reader?
  - Was it recommended by a librarian?
  - Is it a best seller type? Will it receive wide publicity?
  - Literary reputation of the author?
  - Is it a translation?
  - Is it listed in Fiction Catalog or other widely accepted listing?
  - Is it a sequel? Part of a series?
  - Is it the complete book or a condensed version?
  - If a paperbound, was it ever produced in a hardbound?
  - Will it require special qualifications of narrator (dialect, foreign language, etc.)?

- Censorship

Though there is no censorship exercised in a strict sense, the very fact that some books are selected and other excluded may be considered a form of censorship.

In addition, selection criteria have been outlined by the Collection Development Section of the DBPH, dated August 13, 1974:

- Selection of books for the collection involves a consideration of what has already been selected in the subject area and the media previously used, the audience to which the title will appeal and its potential popularity, and the format of the book and media to which it best lends itself.

- Criteria used for the selection of periodicals include the above, plus consideration of whether the periodicals reflect current thinking in the various fields represented, have high interest and demand, are representative in their points of view and provide recreational - as well as information reading.

- In the area of non-fiction, the collection offers representative coverage in all major subject areas, with selective coverage in sub-areas. Broad trends in public interests, knowledge of developing theories and practices in the various subject areas and availability of appropriate titles suitable for reproduction are the major selection criteria. Attention is also paid to authenticity and documentation, development of material in areas of particular interest to the readership, classic and standard material, contemporary works, specialized works when such works are of interest to educated laymen; and the works' potential for educated laymen and potential for recreational reading and reference.

- The DBPH offers selective coverage of titles in foreign languages, based on the relative size of the language group in the overall readership. Children's titles, including bilingual editions, and titles that may be used by adults for self-education, are included. The DBPH seeks to coordinate and cooperate with its network and other groups in meeting needs in this area.

- The collection does include reference works where it is practical. Readers requiring information from highly specialized reference tools may be better served through the DBPH's network and its coordinated use of volunteers.

- Standard works relating to the world's major religions, such as their Holy Books, may be provided in proportion to demand.

- Titles which serve only propaganda purposes, in any subject area, are excluded - except where important documents or speeches by important individuals are included.

- The depth and range of material provided in any area is dependent on the balancing of the collection, the amount of material available which is appropriate for reproduction, and expressed reader interest.

- In the area of fiction, selection of novels for the collection involves the meeting of recreational and educational reading needs of a large readership with vastly different tastes, interests, purposes and reading levels. Therefore, the collection contains not only representative works of popular and cultural value but representative works of popular and experimental interest, as well. The quantity produced of any title is dependent on the pertinency of the work to the collection and to meeting readers' needs. Criteria applied differ from title to title. Works are evaluated on their individual merit and on the relationship to the collection.

- Reviewing Tools

Reviewing tools presently used in selecting book titles are as follows:

- *AAAS Science Books*
  Appraisal - Children's Science Books
  Atlantic
  Best Sellers
  Best Seller Books for Children
  Book Review Digest
  Book World
  Booklist
  Books for Elementary School Libraries
  Bulletin of the Center for Children's Books
  Childhood Education
  Children
  Children's Book Review Service
  Children's Catalog
  Elementary English

English Journal
Fiction Catalog
Harper's
Hornbook
Junior High School Library Catalog
Library Journal
New York Review of Books
New York Times Book Review
Public Library Catalog
Publisher's Weekly
Saturday Review/World
Senior High School Library Catalog
Top of the News
Virginia Kirkus Service

- Accession Lists from:

  - Armed Forces Library
  - Cleveland Public Library
  - Enoch Pratt Library
  - New York Public Library
  - Prince Georges County Libraries

- Book Lists from:

  - American Library Association
  - Enoch Pratt Library
  - New York Public Library
  - Prince Georges County Libraries

- Foreign language books are selected from Accession Lists from:

  - Los Angeles Public Library
  - New York Public Library
  - Americas
  - Book List
  - Publisher's catalogs
  - Recommendations from regional libraries

- Other lists which are examined include:

  - National Book Award
  - Newberry-Caldecott Awards and Runner-Up List
  - Nobel Prize Winners
  - Notable Book Awards
  - Pulitzer Prize Winners

- Automatic Selection

  Some titles are added to the collection automatically, with a minimum amount of consideration being given to them. These included works which are on best seller lists, selections for major book clubs, starred items in standard reviewing tools or titles which appear in standard catalogs. Titles appearing in the following tools or selected for the following book clubs may be purchased and processed without further review (DBPH librarians on staff initial what is to be purchased; if three librarians initial the same item, automatic selection occurs):

  - Booklist
    Book-of-the-Month Club Selections
    Children's Literature
    Fiction Catalog
    Junior High School Library Catalog
    Literary Guild Selections
    New York Times Best Seller List
    Paperback Books Best Seller List
    Public Library Catalog
    Publisher's Weekly Best Seller List
    Senior High School Library Catalog
    Virginia Kirkus Service

- Reviewing tools presently used in selecting magazines are as follows:

  - Library Journal
  - Magazines for Libraries
  - Periodicals for School Libraries
  - Magazines for Small Public Libraries
  - Wilson Library Bulletin

B.8 Conclusions and Recommendations

In summarizing the information presented herein, it cannot be emphasized enough that the largest source of data (the NAS) is now six years old and that the second source of data (the OCBP) is already two years old. Additionally, the most recent source of readership information (the OCBP) is based upon a relatively small and select population (cassette machine readers only). The time difference and population format usage difference produced some significantly different results. Based on the time difference alone, the following trends in readership characteristics can be noted:

- While a disproportionate percentage of the blind and physically handicapped fall into the 65 plus age category, the total population is growing younger: 43% of the readership was 65 years of age and over in 1969 and 28.0% in 1973;

- Educational level attained remained about the same between 1969 and 1973;
- The sexes were equally represented in both years (total readerships), but a larger proportion of female readers were noted in the 65 years of age and over category in both years;
- While a disproportionate percentage of blind and physically handicapped were unemployed, the percentage of those unemployed (total readership) is decreasing: 52.7% were retired or unemployed in 1969 and 27.0% in 1973;
- Residence (community vs. institution) remained about the same between 1969 and 1973, and
- Handicap classification profiles remained about the same between 1969 and 1973.

With respect to subject matter preferences, the question arises as to how the most meaningful comparison can be made between the NAS, which surveyed readers using all formats, and the OCBP, which surveyed only those readers using the cassette machine. Since the scope of this report is meant to encompass only recorded media, evaluation of trends in subject matter preferences will be based upon a comparison between 1) that segment of the NAS population that desires to borrow recorded media in the future and 2) the total OCBP population. Based upon this type of comparison, the following conclusions can be drawn:

- Best sellers (fiction) have replaced general interest magazines (non-fiction) as the most desired type of subject matter;
- Current periodicals (non-fiction) have replaced current events, news and popular culture (non-fiction) as the second most desired type of subject matter;
- Mystery stories (fiction) have replaced best sellers (fiction) as the third most desired type of subject matter, and
- History (non-fiction) has replaced pleasant novels, family stories and light romances (fiction) as the fourth most desired type of subject matter.

With respect to readership ratings of the selection of material available, it is impossible to compare the two studies since the NAS surveyed the selection of all special material available through the DBPH, while the OCBP surveyed only the selection of the material available on cassettes. It is of special interest to note, however, that the highest percentage of the total NAS population that rated the selection as "poor", as well as the second lowest percentage of the total NAS population that rated the selection as "very good" represented that segment of the population that expressed the desire to borrow cassette tapes in the future.

With respect to equipment, the older reports indicated that there was a drastic shift in population preference away from the Talking Book Machine on records toward the Cassette Book Machine, even when one allows for the fact that only cassette readers were surveyed in 1973. In 1969, 76.5% of the population preferred Talking Book Machines on records and in 1973, 83% of the population preferred Cassette Book Machines. In addition, DBPH information demonstrates that the average increase in readers using the tape format is greater than the average increase in readers using the disc format over the time period FY 1970 to FY 1974 (30.6% average increase for tapes and 21.6% average increase for discs).

To substantiate:

	DISC		CASSETTE	
Fiscal Year	Number of Readers	% Increase or Decrease	Number of Readers	% Increase or Decrease
1970	182,440	+36	18,100	+32
1971	207,120	+13	22,110	+22
1972	270,860	+31	32,810	+48
1973	317,460	+17	46,540	+42
1974	352,460	+11	50,790	+ 9
Average Increase		+21.6		+30.6

B.9 Additional Survey Data

B.9.1 Material Readers Desire to Read More Often - NAS (Nelson Associates Survey)

Type of Material	Percentage of Total Readership
FICTION	
Pleasant novels, family stories, light romances	52.2
Best sellers	51.7
Outstanding authors of the 19th Century and 20th Century	46.9

Type of Material	Percentage of Total Readership
FICTION - continued	
Short stories	42.7
Science fiction, mysteries, westerns	35.3
Books in which sex, violent action and/or strong language are treated frankly	12.5
NON-FICTION	
General interest magazines	63.9
Current events: news, popular culture	57.4
Biography	45.3
History	44.5
Bible, religious reading	40.6
Animals and nature	34.5
Science	23.0
Philosophy, psychology	21.7
Special interest magazines	21.2
Music, poetry, performing arts	20.7
Recreational: hobbies, crafts, sports, games, ham radio	17.4
Instructional: music, language, public speaking, vocational	17.0

B.9.2 Material Readers Desire to Read More Often - OCBP (Ohio Cassette Book Project)

Type of Material	No. Requesting
Best selling fiction	84
Periodicals	77
Mystery stories	71
History	61
Travel	57
Biography	56
Nature	47
Religion	47
Bible commentary history, text	(12)
Judeo-Christian	(1)
Catholic	(4)
Baptist	(3)
Presbyterian	(1)
Eastern	(1)
Sermons	(2)
Inspirational	(1)
All faiths	(3)
Light romance	45
Psychology	37
Science	33
For Layman general	(6)
Science fiction	(9)
Biology	(4)
Space	(3)
Medicine	(8)
Psychology	(2)
social science	(1)
earth	(1)
oceanography	(1)
astronomy	(1)
anthropology	(1)
communication	(1)
auto mechanics	(1)
zoology	(1)
weather rockets	(1)
Westerns	32
Philosophy	30
Foreign Lang.	29
French	(10)
Spanish	(10)
German	(4)
Italian	(2)

Type of Material	No. Requesting
Foreign Lang. (cont.)	
Russian	(1)
Hebrew & Yiddish	(2)
Children's Books	24
Business	23
Cook Books	19
Textbooks	19
High School	(11)
College	(8)
Special Subjects: Religion, parent teaching guides for handicapped child, black history, business, techical cources, home management, rehabilitation material	
Law	15
Other:	
Humor	3
Animal stories	2
Short stories	2
Sports	5
Current events	2
Historical fiction	4
Electronics engineering, technical courses	(3)
Vocab. teaching	(1)
Classics	(2)
Music (classic, religious, opera)	(6)
Grooming	(2)
Detective, adventure, spy	(3)
How to books, hobbies	(2)
Astrology	(1)
Drugs, Org. Crime	(2)
Newspaper	(2)
Plays	(1)
Rhymes	(1)
White House Conf. on Aged	(1)
Brownie Handbook	(1)
Dog Breeding	(1)
"Tapes describing & comparing different articles in detail"	(1)

B. 9. 3 Readers' Written Requests for Magazines - NAS (Nelson Associates Survey)

Life
* Readers Digest
Redbook
* National Geographic
* Good Housekeeping
Saturday Evening Post
Look
Ladies Home Journal
Time
* Newsweek
* U.S. News and World Report
McCall's
Guide Post
* Ebony
* Harper's
* Holiday
House and Garden
* American Heritage
* Atlantic Monthly
Catholic Digest
* Changing Times
Cosmopolitan
Woman's Day
Argosy
Hot Rod
Popular Mechanics
Seventeen
American Home
Better Homes and Gardens
Christian Life
* Farm Journal
* Jack and Jull
Mad
Movie magazines
Playboy
* Q.S.T.
* Sports Illustrated
* True
True Story
Western Magazine

* Titles represent those current periodical issues currently available through the Library of Congress recorded media service.

B.9.4 Readers' Written Requests for Magazines - OCBP (Ohio Cassette Book Project)

* Readers Digest
* Newsweek
Time
Life
* Changing Times
* Good Housekeeping
Ladies Home Journal
* National Geographic
* Sports Illustrated
* U.S. News and World Report
* True
* Ellery Queen
Playboy
Better Homes and Gardens
* Ebony
Look
Cosmopolitan
* Natural History
Seventeen

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* Titles represent those current periodical issues currently available through the Library of Congress recorded media service.

APPENDIX C

REGIONAL AND SUBREGIONAL LIBRARIES AND MACHINE-LENDING AGENCIES COOPERATING WITH THE LIBRARY OF CONGRESS TO SERVE BLIND AND PHYSICALLY HANDICAPPED READERS

(January 1, 1975)

ALABAMA
Regional
*Alabama Institue for Deaf and Blind
Subregionals
Public Library of Anniston and Calhoun County
Birmingham Public Library
Houston Memorial Library
Huntsville Public Library
Montgomery Public Library
Mobile Public Library
Tuscaloosa Friedman Library

ALASKA
Subregional
*Alaska Division of State Libraries

ARIZONA
Regional
Arizona State Department of Library and Archives
Subregionals
Flagstaff Library
Yavapai County Library System
Machine-Lending Agency
Section of Rehabilitation for the Visually Impaired, Arizona Department of Economic Security

ARKANSAS
Regional
Arkansas Library Commission
Subregionals
Ozarks Regional Library
CLOC Regional Library
Fort Smith Public Library
Crowley Ridge Regional Library
Machine-Lending Agency
Rehabilitation Services for the Blind, Arkansas Department of Social and Rehabilitative Services

CALIFORNIA
Regionals
California State Library
*Braille Institute of America
Subregional
San Francisco Public Library
Machine-Lending Agencies
Orientation Center for the Blind
Alameda-Contra Costa Central Committee for the Blind

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*Also serves as a Machine-Lending Agency

COLORADO
    Regional
    *Colorado State Library

CONNECTICUT
    Regional
    *Connecticut State Library

DELAWARE
    Regional
    *Delaware Division of Libraries

DISTRICT OF COLUMBIA
    Regional
    *Martin Luther King Memorial Library

FLORIDA
    Regional
    *Bureau of Blind Services, Department of Health and Rehabilitative Services
    Subregional
    Orlando Public Library
    Palmetto Public Library
    Palm Beach County Library
    Tampa Public Library
    Miami-Dade Public Library

GEORGIA
    Regional
    *Georgia State Department of Education
    Subregionals
    Albany-Dougherty County Library
    Augusta-Richmond County Library
    Chattahoochee Valley Regional Library
    Middle Georgia Regional Library
    Oconee Regional Library
    Savannah Public Library
    South Georgia Regional Library
    S.W. Georgia Regional Library

HAWAII
    Regional
    Hawaii State Library System
    Machine-Lending Agency
    Services for the Blind Branch, Hawaii Department of Social Services and Housing

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*Also serves as a Machine-Lending Agency

IDAHO

Regional
*Idaho State Library
Machine-Lending Agency
Idaho Commission for the Blind

ILLINOIS

Regional
*Chicago Public Library
Subregionals
Kaskaskia Library System
Dominy Memorial Library
Shawnee Library System
River Bend Library System
Rolling Prairie Library System
Lewis and Clark Library System
Gail Borden Public Library
Cumberland Trail Library System
Burr Oak Library System
Western Illinois Library System
Illinois Valley Library System
Northern Illinois Library System
Great River Library System
Matson Public Library

INDIANA

Regional
Indiana State Library
Subregionals
Bartholomew County Library
Elkhart Public Library
Fort Wayne Public Library
Lake County Public Library
New Albany-Floyd County Public Library
Peru and Miami County Public Library
Vincennes Public Library
Machine-Lending Agency
Indiana School for the Blind

IOWA

Regional
*Iowa State Commission for the Blind

KANSAS

Regional
*Kansas State Library

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*Also serves as a Machine-Lending Agency

KANSAS
  Subregionals
  Dodge City Public Library
  Central Kansas Library System
  Hutchinson Public Library
  Kansas City Public Library
  Manhattan Public Library
  Wichita Public Library

KENTUCKY
  Regional
  Kentucky Department of Education
  Machine-Lending Agency
  Kentucky Industries and Rehabilitation Centers for the Blind

LOUISIANA
  Regional
  Louisiana State Library
  Machine-Lending Agency
  Blind Services Program, Louisiana Health and Human Resources Administration

MAINE
  Regional
  *Maine State Library
  Subregionals
  Bangor Public Library
  Cary Library
  Lewiston Public Library
  Portland Public Library

MARYLAND
  Regional
  *Maryland State Department of Education
  Subregional
  Montgomery County Department of Public Libraries
  Machine-Lending Agency
  Blind Industries and Services of Maryland

MASSACHUSETTS
  Regional
  Perkins School for the Blind
  Subregional
  Central Massachusetts Regional Library System
  Machine-Lending Agency
  Massachusetts Commission for the Blind

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*Also serves as a Machine-Lending Agency

MICHIGAN

Regionals
*Wayne County Federated Library System
*Michigan State Library Services
Subregionals
Grand Traverse Area Library Federation
Farmington Public Library
Kent County Public LIbrary
Michigan State Library, Upper Peninsula Branch
Mid-Eastern Michigan Library Cooperative
Washtenaw Area Library System
Willard Library System

MINNESOTA

Regional
Minnesota Braille and Sight Saving School
Machine-Lending Agency
Services for the Blind Section, Minnesota Bureau of Residential Services

MISSISSIPPI

Regional
*Mississippi Library Commission

MISSOURI

Regional
*St. Louis Public Library

MONTANA

Regional
*Montana State Library

NEBRASKA

Regional
*Nebraska Public Library Commission
Subregionals
Hastings Public Library
Kearney Public Library
Kimball Public Library
North Platte Public Library

NEVADA

Regional
Nevada State Library
Machine-Lending Agency
Bureau of Services to the Blind, Nevada Department of Human Resources

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*Also serves as a Machine-Lending Agency

NEW HAMPSHIRE
Regional
*New Hampshire State Library

NEW JERSEY
Regional
New Jersey State Library
Machine-Lending Agency
Commission for the Blind and Visually Impaired, New Jersey Department of Institutions and Agencies

NEW MEXICO
Regional
*New Mexico State Library
Machine-Lending Agency
Services for the Blind, New Mexico Department of Education

NEW YORK
Regionals
*New York Public Library
*New York State Library
Subregionals
Nassau Library System
Suffolk Cooperative Library System

NORTH CAROLINA
Regional
*North Carolina State Library

NORTH DAKOTA
Machine-Lending Agency
Special Services for the Blind and Partially Seeing, North Dakota Department of Vocational Rehabilitation Services

OHIO
Regionals
Cleveland Public Library
Public Library of Cincinnati and Hamilton County
Machine-Lending Agency
Bureau of Services for the Blind, Ohio Rehabilitation Services Commission

OKLAHOMA
Regional
*Oklahoma Department of Institutions, Social and Rehabilitative Services
Subregional
Tulsa City-County Library System

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*Also serves as a Machine-Lending Agency

OREGON

Regional
*Oregon State Library

PENNSYLVANIA

Regionals
*Free Library of Philadelphia
*Carnegie Library of Pittsburgh

RHODE ISLAND

Regional
*Rhode Island Department of State Library Services
Machine-Lending Agency
Services for the Blind, Rhode Island Department of Social and Rehabilitative Services

SOUTH CAROLINA

Regional
*South Carolina State Library
Machine-Lending Agency
South Carolina Commission for the Blind

SOUTH DAKOTA

Regional
*South Dakota State Library
Machine-Lending Agency
Services to the Visually Handicapped, South Dakota Department of Social Services

TENNESSEE

Regional
*Tennessee State Library and Archives

TEXAS

Regional
Texas State Library
Machine-Lending Agency
Texas State Commission for the Blind

UTAH

Regional
*Utah State Library Commission
Machine-Lending Agency
Utah Services for the Visually Handicapped

VERMONT

Machine-Lending Agency
Vermont Department of Libraries

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*Also serves as a Machine-Lending Agency

VIRGINIA
Regional
*Virginia Commission for the Visually Handicapped
Subregionals
Alexandria Library
Arlington County Department of Libraries
Fairfax County Public Library
Newport News Public Library
Roanoke Public Library
Virginia Beach Public Library
C. Bascom Slemp Memorial Library
Brunswick-Greensville Regional Library

WASHINGTON
Regional
*Seattle Public Library

WEST VIRGINIA
Regional
*West Virginia Library Commission
Subregionals
Kanawha County Public Library
Cabell County Public Library
Morgantown Public Library
Carnegie Library of Parkersburg and Wood County
West Virginia School for the Blind

WISCONSIN
Regional
*Milwaukee Public Library
Subregional
Brown County Library

WYOMING
Machine-Lending Agency
Services for the Visually Handicapped, Wyoming Department of Education

PUERTO RICO
Regional
*Puerto Rico Department of Education

VIRGIN ISLANDS
Regional
*St. Thomas Public Library

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*Also serves as a Machine-Lending Agency

APPENDIX D

APPLICATION FOR FREE LIBRARY SERVICE FORM

(NOTE: THIS FORM HAS BEEN RETYPED FOR INFORMATION ONLY.)

DIVISION FOR THE BLIND AND PHYSICALLY HANDICAPPED

THE LIBRARY OF CONGRESS
1291 Taylor Street, N. W.
Washington, D. C. 20542
202-882-5500

APPLICATION FOR FREE LIBRARY SERVICE

Name ______________________________ Telephone ____________
(last) (first) (initial)

Address ____
(street) (city) (state) (zip code)

Date of Birth ____________ Sex ________ Social Security Number ________

In the lending of books and equipment, preference is given, by law, to veterans. Please check here if you have been honorably discharged from the Armed Forces of the United States. ☐

Indicate the disability preventing you from reading standard printed material. Check as many as are applicable:

☐	Blindness	(visual acuity of 20/200 or less in the better eye with correcting glasses, or, the widest diameter of visual field subtending an angular distance no greater than 20 degrees)
☐	Visual Handicap	(inability to read standard printed material without special aids or devices other than regular glasses)
☐	Physical Handicap	(inability to read or use standard printed material as a result of physical limitations, e.g., paralysis, missing arms or hands, extreme weakness)
☐	Reading Disability	(organic dysfunction of sufficient severity as to prevent reading printed material in a normal manner)

In addition to any of the above conditions, do you also have a hearing impairment?

☐ Yes ☐ No If yes, indicate the degree of hearing loss:

☐ Moderate (some difficulty hearing & understanding speech)

☐ Profound (cannot hear or understand speech)

- over -

You may borrow any of the following items. Check those you wish to receive:

- ☐ A Talking Book Machine (plays 8 rpm & 16 rpm disc recordings)
- ☐ Talking Books on discs
- ☐ A Cassette Machine - playback only (plays 1-7/8 ips & 15/16 ips cassettes)
- ☐ Talking Books on cassettes
- ☐ Talking Books on open-reel tape (open-reel tape players are not provided)
- ☐ Braille books
- ☐ Music (instructional texts & scores)

- over -

73-101 (rev. 8/74)

DIVISION FOR THE BLIND AND PHYSICALLY HANDICAPPED

THE LIBRARY OF CONGRESS
1291 Taylor Street, N. W.
Washington, D. C. 20542
202-882-5500

APPLICATION FOR FREE LIBRARY SERVICE

Name of Institution ______________________________

Address ______________________ Telephone ______________
(street)

____
(city) (state) (zip code)

Number of persons unable to read or use standard printed material who will be served:

Talking Book readers ________ Braille readers ________

You may borrow any of the following playback equipment and special attachments. Indicate the quantity needed for each item checked:

		QUANTITY
☐	Talking Book Machine (phonograph)	_____
☐	Cassette Machine (playback only)	_____
☐	Remote Control Unit for Talking Book Machine (turns machine on or off from a remote location; helpful to readers confined to bed or those with limited use of their hands)	_____
☐	Speed Control Unit for Cassette Machine (allows reader to increase or decrease rate of speed at which recording is played)	_____
☐	Plastic Tone Arm Clip for Talking Book Machine (assists in placing tone arm on record; helpful to readers with limited use of their hands)	_____
☐	Headphones for: Talking Book Machine	_____
	Cassette Machine (for individual listening; may also assist readers with impaired hearing)	_____

- over -

D-3

QUANTITY

☐ Pillowphone for: Talking Book Machine ____

Cassette Machine ____
(solely for readers confined to bed)

Playback equipment and special attachments are supplied to eligible institutions on extended loan. If this equipment is not being used in conjunction with recorded reading material it must be returned to the issuing agency.

- over -

I certify that the institution named on page 1 of this form serves persons who are unable to read or use standard printed material because of blindness, visual disabilities or physical limitations. I further certify that the readings materials and equipment borrowed will be used by such persons only.

(signature)

(title)

(address)

(zip code)

(date)

Name of staff member of institution who will be responsible for this service:

Mail the completed application to the regional or subregional library for your area or to:

Division for the Blind and Physically Handicapped
Library of Congress
Washington, D. C. 20542

APPENDIX E

BIBLIOGRAPHY

This portion of the report identifies the pertinent literature which ISR collected and referenced in compiling this Planning Study. The following list covers a variety of documents obtained from various sources. In addition, numerous technological specifications from LC-DBPH were reviewed which formed a basis for investigations.

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